J 8/24/88

Pittsburg-Antioch Corridor

Contra Costa County, California

Alternatives Analysis/ Draft Environmental Impact Report

Vol. 1: TEXT

Prepared for:
Bay Area Rapid Transit District

Prepared by:
Bechtel Civil, Inc.
Michael Brandman Associates, Inc.
and Associated Subconsultants

August 1988

PITTSBURG-ANTIOCH CORRIDOR
CONTRA COSTA COUNTY, CALIFORNIA

ALTERNATIVES ANALYSIS/
DRAFT ENVIRONMENTAL IMPACT REPORT
(State Clearinghouse Number 87111114)

Prepared for:

Bay Area Rapid Transit District

Prepared by:

Bechtel Civil, Inc.
Michael Brandman Associates, Inc.

The preparation of this report has been financed in part by grants from the Urban Mass Transportation Administration, U.S. Department of Transportation. The contents of this report do not necessarily reflect the official views or policy of the U.S. Department of Transportation.

August 1988

COVER SHEET

PITTSBURG-ANTIOCH CORRIDOR
CONTRA COSTA COUNTY, CALIFORNIA

ALTERNATIVES ANALYSIS/
DRAFT ENVIRONMENTAL IMPACT REPORT

ABSTRACT

This document describes and summarizes the transportation impacts, environmental impacts, and costs, and provides a comparative evaluation of, the alternative transportation improvements being considered for Contra Costa County's Pittsburg-Antioch Corridor. The alternatives considered include the "no build" alternative, a transportation systems management alternative, and a number of transportation facility alternatives (high occupancy vehicle lanes, light rail transit, and an extension of the Bay Area Rapid Transit District rail transit). The information contained in this document will be used to select a locally preferred alternative for the corridor. The analysis has been prepared pursuant to the California Environmental Quality Act of 1970, as amended (state Public Resources Code Division 13, Section 21000 et seq.). In addition, the technical analysis follows federal National Environmental Policy Act guidelines.

Volume 1 of this document is the text; Volume 2 is appendices.

COMMENTS ON THE DRAFT EIR

For further information, contact:

Alan Lee
Planning, Budget and Research Department
Bay Area Rapid Transit District
800 Madison Street
P.O. Box 12688
Oakland, California 94604-2688
(415) 464-6169

Written comments should be sent to Alan Lee.

Comments must be received by: September 15, 1988
Date

SUMMARY

S.1 PURPOSE OF THE AA/EIR

The purpose of the Pittsburg-Antioch Corridor Alternatives Analysis/Environmental Impact Report (AA/EIR) is to evaluate transportation improvement alternatives in the corridor between the City of Concord (the existing Bay Area Rapid Transit [BART] terminus in central Contra Costa County) and the City of Brentwood in eastern Contra Costa County. The study was initiated in November 1986 with the overall objective of identifying the best form of transportation improvements to service the rapidly growing cities in this corridor and to improve the linkage between the corridor and the San Francisco-Oakland-Central Contra Costa County regional employment centers. The thorough evaluation of transportation alternatives will enable the selection of a "locally preferred alternative" (including the preferred transit mode and alignment) by the Pittsburg-Antioch Corridor Board of Control. The Board of Control is the policy-making body for the study and consists of representatives from local governments and affected agencies.

The AA/EIR was prepared in conformance with the California Environmental Quality Act (CEQA) of 1970 (Public Resources Code 21000 et seq.), as amended. The document assesses the potential project-related and cumulative impacts resulting from implementation of one of the transportation alternatives. Each environmental topic considers future cumulative developments in the year 2000 (i.e., general plan land use designations and projected traffic volumes) in its analysis. The degree of specificity of analysis is directed at comparing transportation alternatives to provide a basis for selecting a locally preferred alternative.

Previous documents related to the AA/EIR and reviewed as part of this study include the Final Report: Pittsburg-Antioch BART Extension Project (Pittsburg-Antioch BART Extension Board of Control 1976), The Draft Eastern Contra Costa Light Rail Transit Study (Tri-Delta Transit/BARTD 1981), and the Aerial/At Grade Alignment Feasibility Study Along State Route 4 for the BART Pittsburg-Antioch Extension (BARTD 1981). In addition, the Pittsburg-Antioch Corridor AA/EIR work plan includes 33 deliverables leading to the eventual preparation of a Preferred Alternatives Report.

S.2 NEED FOR ACTION

The Pittsburg-Antioch Corridor is a 20-mile-long major travel corridor between the existing terminus BART station in Concord and the City of Brentwood. The west end of the corridor is centered along the Port Chicago Highway between the existing Concord BART Station and State Route 4 south of Clyde. From Clyde, the corridor turns east and is generally centered along State Route 4 and continues over the Willow Pass Grade and on to the City of Brentwood.

The corridor has experienced substantial population growth in recent years. Housing increases in the east Contra Costa County area combined with the substantial increase in employment in central Contra Costa, Alameda, and San Francisco counties have resulted in increased commuting from east Contra Costa County to these employment centers. As the corridor population has grown, State Route 4, which is the only freeway link between east Contra Costa County and the employment centers, has become increasingly congested--severely so during peak periods. Other roadway links to east Contra Costa County are limited to four 2-lane streets, because of the topographic constraints of the Diablo Range and land development patterns. Transit service in the corridor consists of bus routes and park-and-ride facilities with no existing fixed-guideway facilities serving commuters (AMTRAK trains do provide intercity transportation).

Currently, during peak travel periods, State Route 4 between Willow Pass Road (west) in Concord and Willow Pass Road (east) in West Pittsburg is at Level of Service (LOS) F, exceeding the design capacity of the roadway. This congestion, along with the fact that east Contra Costa County is expected to be one of the fastest-growing areas in the entire San Francisco Bay region, results in a deteriorating transportation system. In fact, the Metropolitan Transportation Commission (MTC) projects that the number of commuters out of eastern Contra Costa County via the State Route 4 corridor will increase from 23,600 in 1980 to 63,900 in the year 2000, an increase of 171 percent.

Future transportation demands in the Pittsburg-Antioch Corridor cannot be satisfied by highway improvements alone. Both highway and mass transit improvements are needed. Even if funding were available to widen State Route 4 from four to eight lanes, MTC estimates that the increased traffic would create an LOS of F by the year 2000.

Residents of the Pittsburg-Antioch Corridor attempting to use BART to travel to other areas of the region are hindered by major access constraints. The terminus BART station in Concord is located approximately 1 mile from the nearest freeway ramp (on State Route 242) and 2-1/2 miles from the most direct route off State Route 4. Travel on congested local streets is required both for the persons driving to the Concord BART Station and for those riding on the BART express buses connecting outlying park-and-ride lots with that station. Parking congestion at the station forces BART patrons to park offsite. Weekday work-related and non-work travel on BART is hindered by these access difficulties, affecting residents of both the Pittsburg-Antioch Corridor and areas to the west.

S.3 ALTERNATIVES CONSIDERED

Both highway and transit improvements are needed to satisfy transportation demands along the Pittsburg-Antioch Corridor. The environmental impacts of three basic modes of transportation improvements were examined as part of the AA/EIR:

- Bus: Express and local services that operate either on the existing street/highway system or in busways and High-Occupancy-Vehicle (HOV) lanes. The busway/HOV lane facility would provide an exclusive highway lane or lanes for buses and for vehicles occupied by three or more persons, i.e., buses, vanpools, and carpools, and would incorporate park-and-ride lots adjacent to the roadway.

- Light Rail Transit (LRT): A rail vehicle system that operates similarly to BART, except at a lower level of transit service. LRT has a top speed of 60 miles per hour and draws power from an overhead wire. LRT operates in either a partially or fully dedicated right-of-way at-grade or on an aerial structure. Typically, LRT has more station stops than BART. The LRT system is generally less expensive to construct than BART because at-grade LRT/street crossings are permitted and transit stations can be modest in size.

- BART: Same basic system as the existing BART. BART has a top speed of 80 mph and draws power from a third rail. BART operates in a totally dedicated right-of-way with no at-grade crossings. BART is generally more expensive than light rail transit.

A review of the three basic transportation modes for improving travel within the Pittsburg-Antioch Corridor has led to the eventual analysis of the No Build alternative, six primary transportation alternatives, and five minimum fundable segment (MFS) alternatives. The MFS alternatives are shortened segments of the "full corridor" primary alternatives. The alternatives are listed below and include a mix of transportation modes and various stations and terminus points. The alternatives are depicted in Exhibit S-1.

Alternative 1	- No Build (Existing System and Programmed Improvements).
Alternative 2	- Transportation Systems Management (TSM).
Alternative 3	- Busway/HOV Lanes to Antioch.
Alternative 3A	- Busway/HOV Lanes to Pittsburg.
Alternative 4	- LRT to Antioch via State Route 4.
Alternative 4A	- LRT to West Antioch via State Route 4.
Alternative 5	- LRT to Antioch via State Route 4 and the Southern Pacific Transportation Company (SPTC) railroad right-of-way.
Alternative 6	- BART to North Concord/Martinez.
Alternative 7	- BART to Antioch via State Route 4.

Alternative 7A	- BART to West Pittsburg via State Route 4.
Alternative 7B	- BART to Pittsburg via State Route 4.
Alternative 8	- BART to North Concord/Martinez; LRT to West Antioch via State Route 4.

S.3.1 ALTERNATIVE 1 (NO BUILD)

The No-Build alternative consists of existing and funded highway and transit improvements. Alternative 1 is also an environmental baseline for the AA/EIR.

S.3.2 ALTERNATIVE 2 (TSM)

TSM is a set of low-cost measures that enhance transportation performance and increase auto occupancy within the corridor. The TSM improvements were included in all subsequent alternatives, with modifications to better serve stations and park-and-ride lots.

S.3.3 ALTERNATIVE 3 (HOV TO ANTIOCH—16.4 MILES)

Alternative 3 proposes HOV lanes to Antioch. The alternative would extend north from the existing Concord BART Station in mixed-flow lanes along Concord Avenue, to State Route 242. HOV lanes would be provided at the State Route 242/State Route 4 interchange and continue eastward along State Route 4 to Hillcrest Avenue in the City of Antioch. Direct connection would be provided to park-and-ride facilities at Bailey Road in West Pittsburg, Railroad Avenue in the City of Pittsburg, Somersville Road in the City of Pittsburg, and Hillcrest Avenue in the City of Antioch.

S.3.4 ALTERNATIVE 3A (HOV TO PITTSBURG—10.3 MILES)

This shortened segment of Alternative 3 only extends HOV lanes to Railroad Avenue in Pittsburg.

S.3.5 ALTERNATIVE 4 (LRT TO ANTIOCH—16.2 MILES)

This alternative involves an LRT/BART transfer at the Concord BART Station. The LRT line would then extend along Port Chicago Highway to State Route 4 and then eastward on State Route 4 to Hillcrest Avenue in the City of Antioch. LRT stations would be located at Mount Diablo Hospital, the North Concord/Martinez park-and-ride facility, Bailey Road in West Pittsburg, Railroad Avenue in the City of Pittsburg, Somersville Road in the City of Pittsburg, and Hillcrest Avenue in the City of Antioch.

Legend

HOV LANE ALIGNMENT – ALTERNATIVE 3, 3A

PORT CHICAGO HIGHWAY/
STATE ROUTE 4 ALIGNMENT – ALTERNATIVES 4, 4A, 6, 7, 7A, 7B, AND 8

SOUTHERN PACIFIC TRANSPORTATION
COMPANY ALIGNMENT – ALTERNATIVE 5

STATION LOCATIONS

EXISTING BART LINE

(4) TERMINUS OF ALTERNATIVE

NOTE: (1) – NO BUILD
(2) – TSM

Transportation Alternatives

Pittsburg-Antioch Corridor
AA/DEIR

North 0 1.5 3 MILES

BART

Exhibit S-1

S.3.6 ALTERNATIVE 4A (LRT TO WEST ANTIOCH—12.6 MILES)

This shortened segment of Alternative 4 extends LRT to Somersville Road with intermediate stations located at Mount Diablo Hospital, the North Concord/Martinez park-and-ride facility, Bailey Road in West Pittsburg, and Railroad Avenue in the City of Pittsburg. Alternative 4A also includes an LRT maintenance yard on the northeast corner of State Route 4 and Loveridge Road.

S.3.7 ALTERNATIVE 5 (LRT TO ANTIOCH VIA SPTC—16.7 MILES)

Alternative 5 proposes an LRT system extending to the City of Antioch using the SPTC right-of-way. An LRT/BART transfer facility would be located at the existing Concord BART Station. The line would extend along Port Chicago Highway to State Route 4. It would then turn eastward along State Route 4 to West Pittsburg, where the line would cross to the SPTC right-of-way and continue to the City of Antioch. Stations would be located at Mount Diablo Hospital, the North Concord/Martinez park-and-ride facility, Bailey Road in West Pittsburg, Railroad Avenue in Pittsburg, Somersville Road in Pittsburg, and Lone Tree Road and Hillcrest Avenue in Antioch.

S.3.8 ALTERNATIVE 6 (BART TO NORTH CONCORD/MARTINEZ—2.3 MILES)

Alternative 6 would relocate the BART terminus station from downtown Concord to the North Concord/Martinez park-and-ride facility.

S.3.9 ALTERNATIVE 7 (BART TO ANTIOCH—16.2 MILES)

This alternative consists of a BART extension to Hillcrest Avenue in Antioch. The BART line would extend along Port Chicago Highway, then turn eastward on State Route 4. BART stations would be located at the North Concord/Martinez park-and-ride facility, Bailey Road in West Pittsburg, Railroad Avenue in Pittsburg, Somersville Road in Pittsburg, and Hillcrest Avenue in Antioch. A south yard lead track approximately 900 feet in length would be built within the existing BART maintenance facility south of the Concord BART Station to improve train access to the facility.

S.3.10 ALTERNATIVE 7A (BART TO WEST PITTSBURG—7.1 MILES)

Alternative 7A proposes a shorter BART segment than Alternative 7, with the BART line terminating at Bailey Road in West Pittsburg. One intermediate station would be located at the North Concord/Martinez park-and-ride facility. A south yard lead track approximately 900 feet in length would be built within the existing BART maintenance facility south of the Concord BART Station.

S.3.11 ALTERNATIVE 7B (BART TO PITTSBURG—10.1 MILES)

With this alternative, the BART line would terminate at Railroad Avenue in the City of Pittsburg. Intermediate BART stations would be located at the North Concord/Martinez park-and-ride facility and at Bailey Road in West Pittsburg. A south yard lead track approximately 900 feet in length would be built within the existing BART maintenance facility south of the Concord BART Station.

S.3.12 ALTERNATIVE 8 (BART TO NORTH CONCORD/MARTINEZ; LRT TO WEST ANTIOCH—12.6 MILES)

Alternative 8 is a combination of BART and LRT facilities. BART would be extended to the North Concord/Martinez park-and-ride facility, with a BART/LRT transfer station located at this site. The LRT line would extend to the City of Antioch along State Route 4. LRT stations would be located at Bailey Road in West Pittsburg, Railroad Avenue in Pittsburg, and Somersville Road in Pittsburg.

S.4 ENVIRONMENTAL IMPACTS

An EIR requires the preparation of an objective, full-disclosure document to (1) inform agency decision makers and the general public of the direct and indirect environmental effects of a proposed action, (2) provide mitigation measures to reduce or eliminate potential adverse environmental impacts, and (3) identify and evaluate reasonable alternatives to the proposed project. Impacts not mitigated to a level below that considered "significant" are identified as "significant unavoidable adverse impacts." In accordance with Section 15093(b) of the State CEQA Guidelines, if a public agency approves a project that has significant impacts that are not substantially mitigated (i.e., significant unavoidable adverse impacts), the agency shall state in writing the specific reasons for approving the project, based on the final EIR and any other public information. This is termed, per Section 15093, a "statement of overriding considerations."

Sections 4 and 5 of this AA/EIR detail the environmental impacts that would result from the implementation of the transportation alternatives. The environmental areas determined at the outset of the study to have potentially significant impacts included:

- Social Environment
  - Land Use and Relocations
  - Economic Activity/Demographics
  - Neighborhoods
  - Transportation
  - Visual Quality and Aesthetics
  - Historic and Cultural Sites
  - Parklands
  - Public Services and Utilities

- Physical Environment

  - Geology, Soils, and Seismicity
  - Ecosystems
  - Hydrology and Water Quality
  - Noise and Vibration
  - Air Quality
  - Energy
  - Construction Activity

Table S-1 presents a concise synopsis of the potential environmental impacts from implementation of each of the alternatives. The impacts of the alternatives have been rated according to the following designations: (1) NS, not significant (adverse effects that are not substantial according to CEQA, but that should be mitigated to the extent feasible), (2) S, significant (substantial adverse changes to the environment), and (3) B, beneficial impacts.

S.4.1 ALTERNATIVE 1 (NO BUILD)

Implementation of this alternative would not result in any significant adverse impacts. However, Alternative 1 (No Build) would not realize the benefits of the transportation alternatives in the areas of reduced traffic, air pollution, and energy consumption.

S.4.2 ALTERNATIVE 2 (TSM)

Implementation of this alternative would not result in any significant adverse impacts. However, Alternative 2 (TSM) would not realize the benefits of the transportation alternatives in the areas of reduced traffic, air pollution, and energy consumption.

S.4.3 ALTERNATIVE 3 (HOV TO ANTIOCH)

Development of this alternative would result in significant impacts related to land uses and geologic resources.

Residential, commercial, and industrial uses would be significantly affected by right-of-way acquisitions that would be required along State Route 4 and at the proposed station sites. Uses that would be affected include 9 residences, 12 commercial businesses, and 6 industrial businesses. To reduce the effect on displacing these residences and businesses to a level that is not significant, relocation and assistance programs would be required.

TABLE S-1

SUMMARY OF ENVIRONMENTAL IMPACTS FOR EACH ALTERNATIVE*

Environmental Issue	1	2	3	3A	4	4A	5	6	7	7A	7B	8
	Alternative											
Land Use and Relocations												
Significant effect on corridor-level land uses	None (NS)	None (NS)	Few (S)	Few (S)	Few (S)	Few (S)	Few (S)	Few (S)	Few (S)	Few (S)	Few (S)	Few (S)
Number of stations affecting existing or planned land uses	0 (NS)	0 (NS)	2 (S)	2 (S)	2 (S)	2 (S)	3 (S)	0 (NS)	2 (S)	2 (S)	2 (S)	2 (S)
Rights-of-way needed to be acquired (acres)	0 (NS)	11.2 (NS)	92.9 (S)	50.8 (S)	186.7 (S)	154.7 (S)	169.9 (S)	31.1 (S)	197.6 (S)	75.1 (S)	118.1 (S)	155.8 (S)
Residential Displacements (number of households)	0 (NS)	0 (NS)	9 (S)	8 (S)	17 (S)	16 (S)	44 (S)	22 (S)	25 (S)	24 (S)	24 (S)	24 (S)
Commercial business displacements (number of businesses)	0 (NS)	0 (NS)	12 (S)	12 (S)	13 (S)	13 (S)	28 (S)	10 (S)	19 (S)	10 (S)	19 (S)	19 (S)
Industrial business displacements (number of businesses)	0 (NS)	0 (NS)	6 (S)	6 (S)	0 (NS)	0 (NS)	4 (S)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)
Degree of conformance/conflict with General Plans	C (NS)	C (NS)	C (NS)	C (NS)	C (NS)	C (NS)	PC (S)	C (NS)	C (NS)	C (NS)	C (NS)	C (NS)
Economic/Demographic												
Impact on corridor population	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)

* Legend is on last page of table.

TABLE S-1 (Continued)

Environmental Issue	Alternative 1	2	3	3A	4	4A	5	6	7	7A	7B	8
Impact on regional employment	None (NS)	None (NS)	None (NS)	None (NS)	Some (NS)	Some (NS)	Some (NS)	M (NS)	Some (NS)	M (NS)	Some (NS)	Some (NS)
Impact on real estate development	None (NS)	None (NS)	None (NS)	None (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)
Impact on station area development	None (NS)	None (NS)	None (NS)	None (NS)	Some (NS)	Some (NS)	Some (NS)	None (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)
Impact on revenues and tax base	None (NS)	None (NS)	None (NS)	None (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)
Neighborhoods												
Disruptions of existing neighborhoods (number of neighborhoods affected)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	1 (NS)	1 (NS)	7 (NS)	1 (NS)	1 (NS)	1 (NS)	1 (NS)	1 (NS)
Transportation												
Station area streets with adverse level of service change (to "D" or worse)	N/A --	0 (NS)	2 (NS)	1 (NS)	1 (NS)	1 (NS)	3 (NS)	2 (NS)	3 (NS)	2 (NS)	2 (NS)	3 (NS)
Daily travel time Savings in hours	0 (NS)	700 (B)	1,750 (B)	1,650 (B)	1,550 (B)	1,600 (B)	1,600 (B)	1,900 (B)	3,350 (B)	2,800 (B)	3,050 (B)	2,850 (B)
Visual Quality and Aesthetics Impacts												
Port Chicago Highway Area	None (NS)	None (NS)	None (NS)	None (NS)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)
State Route 242	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)

JBX/4580001E1x

TABLE S-1 (Continued)

Environmental Issue	Alternative 1	2	3	3A	4	4A	5	6	7	7A	7B	8
State Route 4	None (NS)	None (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	None (NS)	M (NS)	M (NS)	M (NS)	M (NS)
Willow Pass Road Area	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	S (S)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)
Southern Pacific Transportation Company	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)	M (NS)	None (NS)	None (NS)	None (NS)	None (NS)	None (NS)
Historical and Cultural Sites												
Number of known archaeological sites affected	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)
Number of historical sites affected	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	3 (S)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)
Parklands												
Significantly affected number of bike routes	0 (NS)	0 (NS)	0 (NS)	0 (NS)	1 (S)	1 (S)	1 (S)	1 (S)	1 (S)	1 (S)	1 (S)	1 (S)
Significantly affected number of parks	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (S)	0 (NS)	0 (NS)	0 (NS)	0 (NS)	0 (NS)
Public Services and Utilities												
Impact on police services (YES/NO)	NO (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)
Impact of fire protection services (YES/NO)	NO (NS)	NO (NS)	NO (NS)	NO (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)

TABLE S-1 (Continued)

Environmental Issue	Alternative 1	2	3	3A	4	4A	5	6	7	7A	7B	8
Impact on water facilities (YES/NO)	NO (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)
Impact on sewer facilities (YES/NO)	NO (NS)	NO (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)	YES (NS)
Impact on major electrical facilities (YES/NO/PE)	NO (NS)	NO (NS)	NO (NS)	NO (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)
Impact on oil facilities (YES/NO/PE)	NO (NS)	NO (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)	PE (NS)
Geology, Soils and Seismicity Impacts												
Slope stability	None (NS)	None (NS)	MH (S)	MH (S)	MH (S)	MH (S)	MH (S)	MH (S)	MH (S)	MH (S)	MH (S)	MH (S)
Groundwater seepage potential	None (NS)	None (NS)	LH (S)	LH (S)	LH (S)	LH (S)	MH (S)	MH (S)	LH (S)	LH (S)	LH (S)	LH (S)
Compressibility/Shrink/Swell	None (NS)	None (NS)	LH (S)	LH (S)	LH (S)	LH (S)	MH (S)	MH (S)	LH (S)	LH (S)	LH (S)	LH (S)
Seismic	None (NS)	None (NS)	LH (S)	LH (S)	LH (S)	LH (S)	LH (S)	H (S)	LH (S)	LH (S)	LH (S)	LH (S)
Amount of grading required (cubic yards)	None (NS)	None (NS)	740,000 (S)	445,000 (S)	750,000 (S)	500,000 (S)	555,000 (S)	80,000 (S)	790,000 (S)	300,000 (S)	380,000 (S)	790,000 (S)

TABLE S-1 (Continued)

Environmental Issue	Alternative 1	2	3	3A	4	4A	5	6	7	7A	7B	8
Ecosystems												
Impacts on vegetation habitats	None (NS)	None (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)
Impact on wildlife	None (NS)	None (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)
Number of wetland habitat acres impacted	None (NS)	None (NS)	6.0 (NS)	6.0 (NS)	6.0 (NS)	6.0 (NS)	9.4 (NS)	0.0 (NS)	6.0 (NS)	6.0 (NS)	6.0 (NS)	6.0 (NS)
Hydrology and Water Quality												
Impacts on surface water	None (NS)	None (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)
Impacts on groundwater	None (NS)	None (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)
Impacts on floodplains	None (NS)	None (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)
Noise and Vibration												
Noise effect on adjacent uses	None (NS)	None (NS)	M (NS)	M (NS)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)
Vibration effect on adjacent uses	None (NS)	None (NS)	None (NS)	None (NS)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)
Air Quality												
Impact on ambient air quality	None (NS)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)

TABLE S-1 (Continued)

Environmental Issue	Alternative 1	2	3	3A	4	4A	5	6	7	7A	7B	8
<u>Energy</u>												
Effect on energy consumption	None (NS)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)	B (B)
<u>Construction Activities</u> Impact on Ecosystems	None (NS)	None (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)
Impact on Hydrology and Water Quality	None (NS)	None (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)	Some (NS)
Impact on noise and vibration	None (NS)	None (NS)	M (NS)	M (NS)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)	S (S)
Impact on Air Quality	None (NS)	None (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)	M (NS)

(S) - Significant
(NS) - Not Significant
C - Conforms
PC - Potentially Conforms
PE - Potential Effect
B - Beneficial
M - Minimal
LH - Low to High
MH - Moderate to High
H - High

Significant effects related to geologic resources would also result from the implementation of this alternative. The soils along this alternative alignment, specifically in North Concord and along State Route 4 west of Bailey Road, have a moderate to high potential for erosion and landslides. To reduce potential landslide effects to a level that is not significant, specific slope stabilization measures should be implemented. Erosion effects could be reduced to a level of insignificance with the implementation of revegetation, terracing, and grading. High groundwater may also significantly affect this alternative along State Route 4 west of Port Chicago Highway and also along State Route 4 in the City of Pittsburg. To reduce this potential effect to a level that is not significant, a temporary or permanent dewatering program would need to be implemented if groundwater seepage occurs. The soils along this alternative alignment also have shrink and swell characteristics, specifically along State Route 242 and State Route 4. To reduce this potential effect to a level of insignificance, over-excavation and replacement with engineering fill should be implemented. In addition, natural drainage courses should be diverted from the alignment.

Due to the presence of faults crossing this alternative, seismic effects could result. There is a high groundshaking potential, low to high liquefaction potential, and a high potential for surface rupture along this alignment. To reduce these potential seismic effects to a level that is not significant, appropriate foundation design should be incorporated into this alternative. The implementation of this alternative would require approximately 740,000 cubic yards of cut and fill material. Routes to haul fill material would be established to minimize interference with existing traffic.

After the implementation of the recommended mitigation measures, no significant effects would result with the implementation of this alternative.

S.4.4 ALTERNATIVE 3A (HOV TO PITTSBURG)

Alternative 3A would result in similar significant impacts to Alternative 3. The same measures recommended for Alternative 3 can be applied to the significant effects resulting from the implementation of this alternative. After the mitigation measures are implemented, no significant effects would result.

S.4.5 ALTERNATIVE 4 (LRT TO ANTIOCH)

This alternative would result in significant effects related to land use, visual quality and aesthetics, parklands, geologic resources, noise and vibration, and construction activities.

Residential (17 residences) and commercial (13 businesses) uses would be significantly affected by right-of-way acquisitions required for this alternative. To reduce the effect of displacing residences and businesses to a level that is not significant, relocation and assistance programs would be implemented. In addition, the City of Concord General Plan would be significantly affected due to the proposed rail line to the Port Chicago Highway from the existing BART station in Concord. To reduce this effect to a level of insignificance, amendments are necessary to the land use and circulation elements.

The visual and aesthetic quality of the Port Chicago Highway area (north of Salvio Street) would be significantly affected by the light rail facilities which would be elevated within the Port Chicago Highway median. No measures are recommended to reduce this affect, therefore this affect would be a significant unavoidable impact.

Parklands would also be significantly affected by the implementation of this alternative. The Port Chicago Highway Bike Route would be significantly affected north of High School Avenue to its terminus near State Route 4 because the bike path would need to be removed. To reduce the significant effect on the bike path to a level of insignificance, the bike path should be relocated within the existing Port Chicago Highway right-of-way.

Significant effects related to geologic resources would also result from the development of this alternative. These significant effects would be similar to the effects that would result from the implementation of Alternative 3 (HOV to Antioch). The same geotechnical mitigation measures recommended for Alternative 3 can be applied to the significant effects resulting from this alternative. After implementation of the mitigation measures with this alternative, no significant effects relating to geologic resources would result.

Noise and vibration effects on adjacent land uses are expected to be significant for this alternative. Significant noise and vibration effects on Port Chicago Highway residences would result along at-grade sections of the alignment. The significant vibration effects would result where an aerial structure support column is within 30 to 40 feet of a single-family residence and where houses are within 25 feet of an at-grade section. To reduce noise to a level that is not significant, noise walls may need to be constructed. To reduce vibration effects to a level that is not significant, special resilient rail fasteners and special "ballast mats" may need to be implemented.

Significant noise levels would also result east of Bailey Road at a nearby elementary school and residences. To reduce noise to a level that is not significant, a sound barrier wall or special crossover switches ("frogs") may need to be installed. In addition, a few commercial buildings and two residences near the East Antioch Station would be significantly affected by noise. To reduce this noise impact to a level that is not significant, a sound barrier wall on the inbound side of the alignment would need to be built.

During construction activities, significant noise and vibration effects would also occur. To reduce these effects to a level that is not significant, the project should comply with state and local noise ordinances and regulations.

After the implementation of the recommended mitigation measures, significant effects related to visual quality and aesthetics would remain. Therefore, this alternative would result in a significant unavoidable adverse impact on visual quality and aesthetics.

S.4.6 ALTERNATIVE 4A (LRT TO WEST ANTIOCH)

Implementation of this alternative would result in similar significant impacts to Alternative 4 (LRT to Antioch). The addition of the LRT maintenance yard would cause no new significant impacts. The same measures recommended for Alternative 4 can be applied to the significant effects resulting from the implementation of this alternative. After the mitigation measures are implemented with this alternative, significant effects related to visual quality and aesthetics would remain. Therefore, this alternative would result in a significant unavoidable adverse impact on visual quality and aesthetics.

S.4.7 ALTERNATIVE 5 (LRT TO ANTIOCH VIA SPTC)

Development of this alternative would result in significant effects related to land use, neighborhoods, visual quality and aesthetics, parklands, cultural resources, noise and vibration, and construction activities.

Land uses that would be significantly affected by right-of-way acquisitions required for this alternative include 44 residences, 28 commercial businesses, and 4 industrial businesses. To reduce the effect of displacing residences and businesses to a level that is not significant, relocation and assistance programs would be developed. In addition, significant effects to the City of Concord General Plan would result. As with Alternative 4, the general plan's land use and circulation elements should be amended to include the transportation use. Disruptions to seven neighborhoods would also occur with this alternative.

The visual quality of the Port Chicago Highway area (north of Salvio Street) and the Willow Pass Road area would be significantly affected by the light rail facilities which would be elevated within the Port Chicago Highway and Willow Pass Road medians. No measures are recommended to reduce these effects; therefore, these effects would be significant unavoidable impacts.

Significant effects relating to parklands, noise and vibration, and construction activities resulting from the implementation of this alternative would be similar to the significant effects resulting from the development of Alternative 4 (LRT to Antioch). The measures recommended for Alternative 4 can be applied to the significant effects resulting from this alternative.

In addition, this alternative would result in significant effects on historical structures. The Southern Pacific Station and the associated building and movie theatre located in the Pittsburg Station on Railroad Avenue would be adversely affected and would need to be relocated or eliminated. To reduce the significant effect on these structures to a level that is not significant, the Pittsburg Station could be modified to retain the structures, the structures could be relocated to a place where they could be preserved, or if neither of the two previous measures could be implemented, a "Historic American Building Survey" could be accomplished for the structures. The survey would provide detailed information so that the structures could be reconstructed in the future from the survey data.

Another significant effect resulting from this alternative would be a noise effect on residences west of the proposed West Pittsburg Station. To reduce noise to a level that is not significant, a sound barrier wall along the westbound side of the rail structure should be built. Vibration impacts would also be significant along the Southern Pacific Transportation Company railroad line. To reduce vibration impacts to a level that is not significant, standard ballast-and-tie track and a special floating slab at track crossover points should be used.

S.4.8 ALTERNATIVE 6 (BART TO NORTH CONCORD/MARTINEZ)

This alternative would result in 22 residential and 10 commercial business displacements. After the mitigation measures are implemented with this alternative, significant effects related to visual quality and aesthetics, and noise and vibration would remain. Therefore, this alternative would result in significant unavoidable adverse impacts relating to visual quality and aesthetics, and noise and vibration.

S.4.9 ALTERNATIVE 7 (BART TO ANTIOCH)

Implementation of this alternative would result in similar significant impacts to Alternative 4 (LRT to Antioch) except that 25 residences and 19 commercial businesses would be displaced. The same measures recommended for Alternative 4 can be applied to the significant effects resulting from the implementation of this alternative. The south yard lead track would not cause significant impacts. After the mitigation measures are implemented with this alternative, significant effects related to visual quality and aesthetics, and noise and vibration would remain. Therefore, this alternative would result in significant unavoidable adverse impacts related to visual quality and aesthetics, and noise and vibration.

S.4.10 ALTERNATIVE 7A (BART TO WEST PITTSBURG)

Alternative 7A (BART to West Pittsburg) would result in 24 residences and 10 commercial businesses being displaced. The same measures recommended for Alternative 7 can be applied to the significant effects resulting from the implementation of this alternative. After the mitigation measures are implemented with this alternative, significant effects related to visual quality and aesthetics, and noise and vibration would remain. Therefore, this alternative would result in significant unavoidable adverse impacts related to visual quality and aesthetics, and noise and vibration.

S.4.11 ALTERNATIVE 7B (BART TO PITTSBURG)

Implementation of Alternative 7B (BART to Pittsburg) would result in displacement of 24 residences and 19 commercial businesses. The same measures recommended for Alternative 7 can be applied to the significant effects resulting from the implementation of this alternative. After the mitigation measures are implemented with this alternative, significant effects related to visual quality and aesthetics, and noise and vibration would remain. Therefore, this alternative would result in

significant unavoidable adverse impacts related to visual quality and aesthetics, and noise and vibration.

S.4.12 ALTERNATIVE 8 (BART TO NORTH CONCORD/MARTINEZ; LRT TO WEST ANTIOCH)

This alternative would result in similar significant impacts to Alternatives 6 (BART to North Concord/Martinez) and 4 (LRT to Antioch) except that this alternative terminates in West Antioch. Twenty-four residences and 19 commercial businesses would be displaced. The same measures recommended for Alternative 4 can be applied to the significant effects resulting from the implementation of this alternative. There would not be a significant environmental impact from the LRT maintenance yard in Pittsburg. After the mitigation measures are implemented with this alternative, significant effects related to visual quality and aesthetics, and noise and vibration would remain. Therefore, this alternative would result in significant unavoidable adverse impacts related to visual quality and aesthetics, and noise and vibration.

S.5 COSTS

Capital costs and operating and maintenance costs have been estimated for each of the 12 alternatives. The capital costs are based on conceptual engineering drawings, transit patronage and operating plans, and unit construction costs. The operating and maintenance costs are based on projected transportation service by the Eastern Contra Costa Transit Authority, Central Contra Costa Transit Authority, BART Express bus, and BART District light rail and/or rapid rail service.

The costs for each of the alternatives are summarized in Table S-2 along with length of project, number of stations, and weekday transit trips. The capital costs range from $145 million for Alternative 3A (HOV to Pittsburg) to $603 million for Alternative 7 (BART to Antioch). Alternatives 3A and 7 also had the lowest and highest operating and maintenance costs of all the alternatives, with a range from $2.8 million to $13.3 million per year. The lowest annual cost per rider was $4.92 per rider with Alternative 3A (HOV to Pittsburg). Alternative 6 (BART to North Concord/Martinez) at $6.64 per rider and Alternative 3 (HOV to Antioch) at $7.01 per rider had similar costs. The highest annual cost per rider was Alternative 5 (LRT to Antioch via SPTC), at $24.90 per rider. Alternative 4 (LRT to Antioch via State Route 4) was only marginally lower, at $23.15 per rider.

S.6 EVALUATION OF ALTERNATIVES

Alternative 1 (No Build) and Alternative 2 (TSM) would have minimal impacts on the environment. The HOV Alternatives 3 and 3A would result in some residential and business displacements with minimal other environmental impacts. Of the 10 transportation development alternatives, the HOV alternatives have the lowest and third-lowest costs per rider. However, interviews with civic and community leaders indicated that HOV lanes are viewed as a low-cost, short-term solution that would only minimally alleviate transportation problems.

TABLE S-2

RIDER COSTS BY TRANSPORTATION ALTERNATIVE (1987 DOLLARS)

Alter-native		Length of Project (Miles)	Number of Stations	Projected Guideway Weekday Transit Trips (Year 2000)	Estimated Guideway Capital Cost (Million $)	Estimated Annual O&M Cost (Million $)	Total Annualized Capital and O&M Cost Per Guideway Rider ($)
1	**No Build**	NA	NA	NA	NA	NA	NA
2	**TSM**	NA	NA	NA	NA	NA	NA
	Busway/HOV						
3	Concord to Antioch	16.4	4	13,150[a]	$215[b]	$3.7[b]	$7.01[b]
3A	Concord to Pittsburg	10.3	2	12,850[a]	$145[b]	$2.8[b]	$4.92[b]
	LRT via State Route 4						
4	Concord to Antioch	16.2	6	8,300	$431	$9.5	$23.15
4A	Concord to W. Antioch	12.6	5	8,075	$352	$8.3	$19.67
	LRT via SPTC						
5	Concord to Antioch	16.7	7	8,375	$469	$10.2	$24.90
6	**BART to N. Concord/ Martinez**	2.3	1	10,850	$165	$3.2	$6.64
	BART via State Route 4						
7	Concord to Antioch	16.2	5	13,450	$603	$13.3	$19.99
7A	Concord to W. Pittsburg	7.1	2	12,000	$301	$6.1	$11.03
7B	Concord to Pittsburg	10.1	3	13,175	$426	$8.5	$14.18
8	**BART to N. Concord/ Martinez, LRT to W. Antioch via State Route 4**	12.6	4	11,800	$445	$10.1	$16.90

a Includes bus and HOV riders
b Busway/HOV alternatives do not include automobile capital or operating costs.

JBX/4580001E1x

The LRT Alternatives 4, 4A, and 5 would have noise and visual impacts along Port Chicago Highway along with displacements of residents and businesses. Alternative 5 (LRT to Antioch via SPTC) would additionally have significant impacts in the areas of neighborhoods disrupted and historical sites affected. Of the 12 alternatives, the LRT alternatives represent three of the four highest costs per rider. Community responses indicated that LRT is considered a more realistic solution than BART, and is popular with the public. However, LRT concerns included inconvenience of transferring from/to BART, appearance of overhead wires, and at-grade crossings. In addition, the traffic impacts in the vicinity of an intermodal BART/LRT station in downtown Concord would be severe. The LRT alternatives would provide smaller travel time savings than the HOV alternatives because of transfers from auto to LRT to BART.

BART Alternative 6 (BART to North Concord/Martinez) would displace a number of residences and businesses, but also serve to substantially reduce downtown Concord congestion. While this alternative has the second-lowest per-rider cost, it also only provides one additional station and 2.3 miles of service.

The BART Alternatives 7, 7A, and 7B would have similar environmental impacts to the LRT, except no overhead wires. Residences and businesses would be displaced. BART costs per rider are generally in between those of the HOV and LRT alternatives. Civic and community leaders interviewed as part of the community involvement program supported BART because of its proven quality and performance. However, high costs and inflexibility of routes were also mentioned as major disadvantages. The BART alternatives, because of their speed, would provide the greatest travel time savings, and would reduce congestion in downtown Concord.

A combination of BART and LRT was examined with Alternative 8. This alternative would have typical BART environmental impacts along Port Chicago Highway to North Concord/Martinez, and typical LRT impacts to Antioch. Residents and businesses would be displaced with this alternative. The costs per rider were in the mid-range of the 12 alternatives. The extension of BART to North Concord/Martinez would reduce congestion in downtown Concord.

S.7 AREAS OF CONTROVERSY AND ISSUES TO BE RESOLVED

S.7.1 AREAS OF CONTROVERSY

Areas of potential controversy associated with the transportation alternatives include:

1. Right-of-way acquisitions; displacements of residents and businesses.

2. Visual impacts associated with LRT and BART along Port Chicago Highway.

3. Noise impacts on existing residential land uses.

S.7.2 ISSUES TO BE RESOLVED

The following issues must be resolved prior to project development.

1. General plan amendment for West Pittsburg (SPTC) station to be consistent with current land use designations (Alternative 5 only).

2. Acquisition of right-of-way.

3. Construction plan describing slope stabilization measures, dewatering program, and foundation design considerations to mitigate seismic hazards.

4. Engineering design to determine need and requirements for noise and vibration mitigation.

5. Selection of Locally Preferred Alternative by Board of Control.

6. Commitment of funding by local, state, and federal sources.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

JBX/4580001E1'

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF TABLES (Continued)

JBX/4580001E1t

LIST OF TABLES (Continued)

LIST OF TABLES (Continued)

LIST OF EXHIBITS

LIST OF EXHIBITS (Continued)

ACRONYMS AND ABBREVIATIONS

AA	--	Alternatives Analysis
ABAG	--	Association of Bay Area Governments
APD	--	Antioch Police Department
APE	--	Area of Potential Environmental Impact
APTA	--	American Public Transit Association
AT&SF	--	Atchison, Topeka and Santa Fe
BAAQMD	--	Bay Area Air Quality Management District
BART	--	Bay Area Rapid Transit (Existing Fixed Rail System)
BARTD	--	Bay Area Rapid Transit District
CCCSD	--	Contra Costa County Sheriff's Department
CCCTA	--	Central Contra Costa Transit Authority
CCWD	--	Contra Costa Water District
CDD	--	Community Development Department
CDFG	--	California Department of Fish and Game
CEQA	--	California Environmental Quality Act
CHP	--	California Highway Patrol
CNDDB	--	California Natural Diversity Data Base
CNEL	--	Community Noise Equivalent Level
CNPS	--	California Native Plant Society
COE	--	U.S. Army Corps of Engineers
CPD	--	Concord Police Department
dBA	--	A-weighted sound level
DEIR	--	Draft Environmental Impact Report
DOT	--	U.S. Department of Transportation
DWR	--	California Department of Water Resources
EBMUD	--	East Bay Municipal Utility District
ECCTA	--	Eastern Contra Costa Transit Authority (or Tri-Delta Transit)
EIS	--	Environmental Impact Statement
EPA	--	U.S. Environmental Protection Agency
FAR	--	Floor Area Ratio
FEMA	--	Federal Emergency Management Agency
FHWA	--	Federal Highway Administration
HOV	--	High Occupancy Vehicle
HPSR	--	Historic Property Survey Report
I/M	--	Inspection/Maintenance
Ldn	--	Day-Night Sound Level
Leq	--	Energy Equivalent Level
LRT	--	Light Rail Transit
LOS	--	Level of Service
L1	--	Level Exceeded One Percent of the Time

m^3	--	Cubic Meter
MFS	--	Minimum Fundable Segment
mg	--	Milligrams
MTC	--	Metropolitan Transportation Commission
NEPA	--	National Environmental Policy Act
PM-10	--	Particulate Matter Less Than 10 Micrometers in Diameter
PPD	--	Pittsburg Police Department
ppm	--	Parts per Million
SFRR	--	Santa Fe Railroad
SHPO	--	State Historic Preservation Officer
SNRR	--	Sacramento Northern Railroad
SPTC	--	Southern Pacific Transportation Company
STIP	--	State Transportation Implementation Plan
TSM	--	Transportation Systems Management
ug	--	Micrograms
UMTA	--	Urban Mass Transportation Administration
USDA-SCS	--	U.S. Department of Agriculture, Soil Conservation Service
USFWS	--	U.S. Fish and Wildlife Service
V/C	--	Volume-to-Capacity Ratio
VMT	--	Vehicle Miles Traveled

SECTION 1

PURPOSE AND NEED

1.1 INTRODUCTION

The Pittsburg-Antioch Corridor Alternatives Analysis/Environmental Impact Report (AA/EIR), initiated in November 1986, evaluates transportation improvement alternatives in the corridor between the City of Concord (the existing BART terminus in central Contra Costa County) and the City of Brentwood (in eastern Contra Costa County). The study has the overall objective of identifying the best transportation alternative to service the rapidly growing cities in this corridor and to improve the linkage between the corridor and the San Francisco-Oakland-Central Contra Costa County regional employment centers. The focus of the AA/EIR is to evaluate potential transportation alternatives in detail to enable the selection of a locally preferred alternative (including the preferred transportation mode and alignment) by the Board of Control. The Pittsburg-Antioch Corridor Board of Control, described further in Section 1.3.3, is the policy-making body for the study, and consists of representatives from the affected agencies and local communities.

It was originally intended that federal funding participation would be sought for the proposed transportation improvement project. Therefore, the study was started as a joint EIR/EIS--the EIR to be prepared by the Bay Area Rapid Transit (BART) District as the local lead agency, with the EIS (environmental impact statement) under the direction of the Urban Mass Transportation Administration (UMTA) as the federal lead agency. Substantial work efforts undertaken up to the time of this study, including the Final Report: Pittsburg-Antioch BART Extension Project (Pittsburg-Antioch BART Extension Board of Control 1976), the Aerial/At Grade Alignment Feasibility Study Along State Route 4 for the BART Pittsburg-Antioch Extension (BARTD 1981), and the Draft Eastern Contra Costa Light Rail Transit Study (Tri-Delta Transit/BARTD 1981) resulted in a UMTA decision to bypass a Phase I Systems Planning Study of the corridor and prepare a Phase II Alternatives Analysis/EIS/EIR.

During the course of the current study it was determined by the Bay Area Rapid Transit District that the transportation alternative could not meet federal funding criteria. Consequently, the study was refocused to suspend the EIS portion and emphasize completion of the EIR pursuant to the California Environmental Quality Act (CEQA). The EIS portion of the study is not being prepared at this time, but may be resumed in the future.

1.2 NEED FOR TRANSPORTATION IMPROVEMENTS WITHIN THE CORRIDOR

1.2.1 EXISTING TRANSPORTATION FACILITIES AND SERVICES

The Pittsburg-Antioch Corridor (see Exhibit 1.2-1) is a major travel corridor which covers approximately 20 miles between the existing terminus BART station in Concord and the City of Brentwood. The west end of the corridor is centered along the Port Chicago Highway between the existing Concord BART station and State Route 4 south of Clyde. The corridor then turns east and is generally centered along

State Route 4 over the Willow Pass Grade and on to the City of Brentwood. Interstate 680 and State Route 242 provide north/south access along the western portion of the corridor and include interchanges with State Route 4.

The corridor area has experienced substantial growth in recent years. Housing increases in the east Contra Costa County area coupled with the substantial creation of new jobs in central Contra Costa, Alameda, and San Francisco counties has resulted in increased commuting from east Contra Costa County to these employment centers. As the corridor population has grown, State Route 4, which is the only freeway link between east Contra Costa County and the employment centers, has become increasingly congested and is severely congested during peak periods. Other roadway links to eastern Contra Costa county are limited to four 2-lane streets due to the topographic constraints of the Diablo Range and to land development patterns. Transportation service in the corridor consists of bus routes and park-and-ride facilities with no existing fixed-guideway facilities serving commuters (although AMTRAK trains provide intercity transportation).

The existing transportation facilities are shown on Exhibit 1.2-2 and are described below.

Existing Freeways

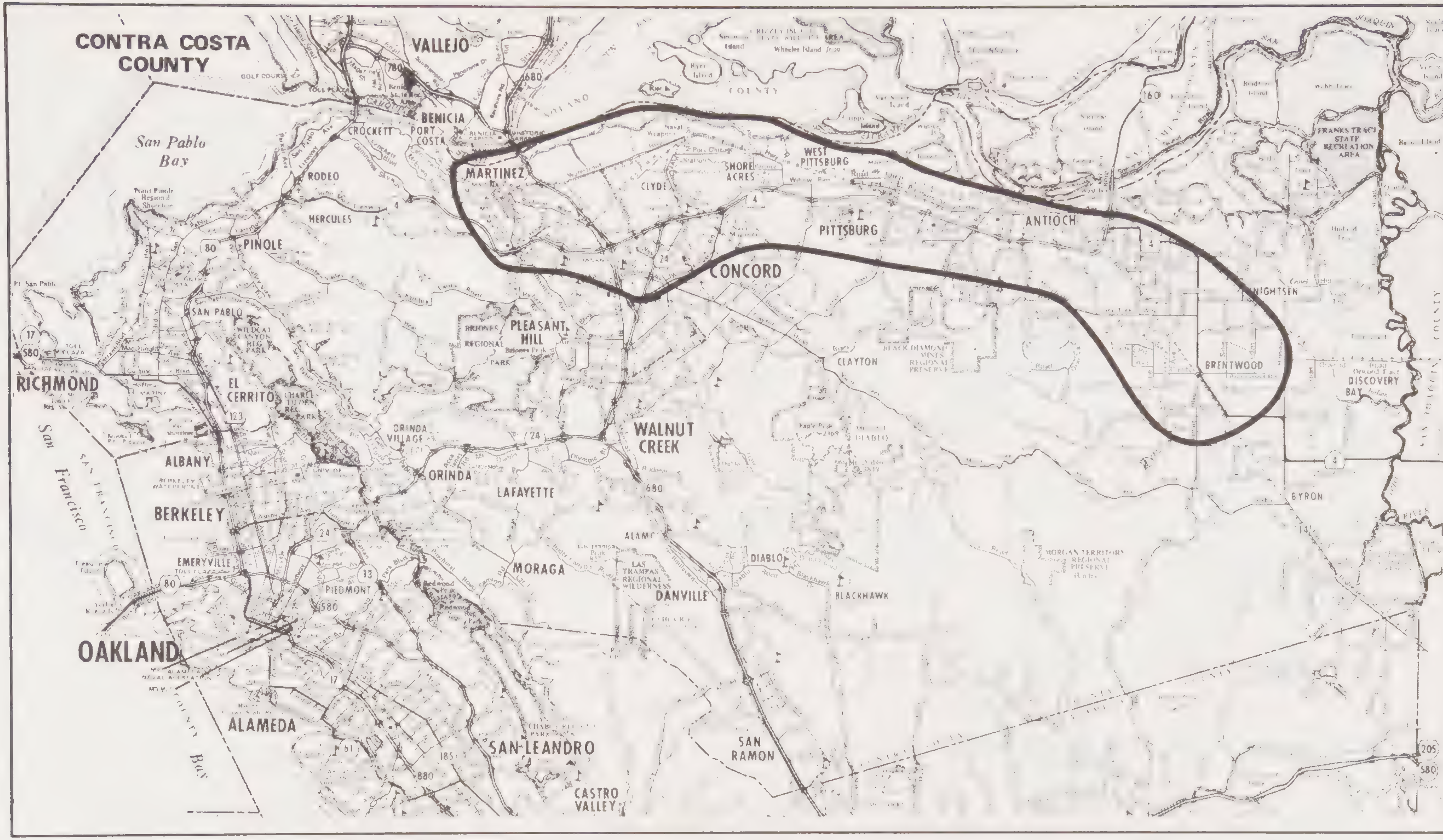
- State Route 4: Six-lane restricted-access highway between Port Chicago Highway and Willow Pass Road (west). Four-lane restricted-access highway between Willow Pass Road (west) and the Antioch Bridge in Antioch. A major constraint to the operation of this roadway is the Willow Pass Grade on State Route 4 which is located approximately two miles east of Port Chicago Highway. This facility is projected by the Metropolitan Transportation Commission (MTC) to operate at Level of Service F (unacceptable delays) in the year 2000 between Somersville Road in Antioch and Willow Pass Road (west) in Concord; and at Level of Service E (limit of acceptable delay) between Willow Pass Road (west) and Port Chicago Highway.

- State Route 242: Four-lane restricted-access highway between State Route 4 and I-680. This facility is projected by MTC to operate at Level of Service E/F (limit of acceptable delay to unacceptable delay) in the year 2000.

- I-680: Six-lane restricted-access highway between State Route 242 and State Route 24. This facility is projected by MTC to operate at Level of Service E/F in the year 2000.

Existing Major Roadway Links

- Port Chicago Highway: Two-lane arterial highway between State Route 4 and Salvio Street in Concord with Level of Service D (long delays) forecast by MTC in the year 2000. The Navy is proposing to close this highway where it passes through the Concord Naval Weapons Station; however, the traffic would remain in the corridor.



Regional Map

Pittsburg–Antioch Corridor

AA/DEIR

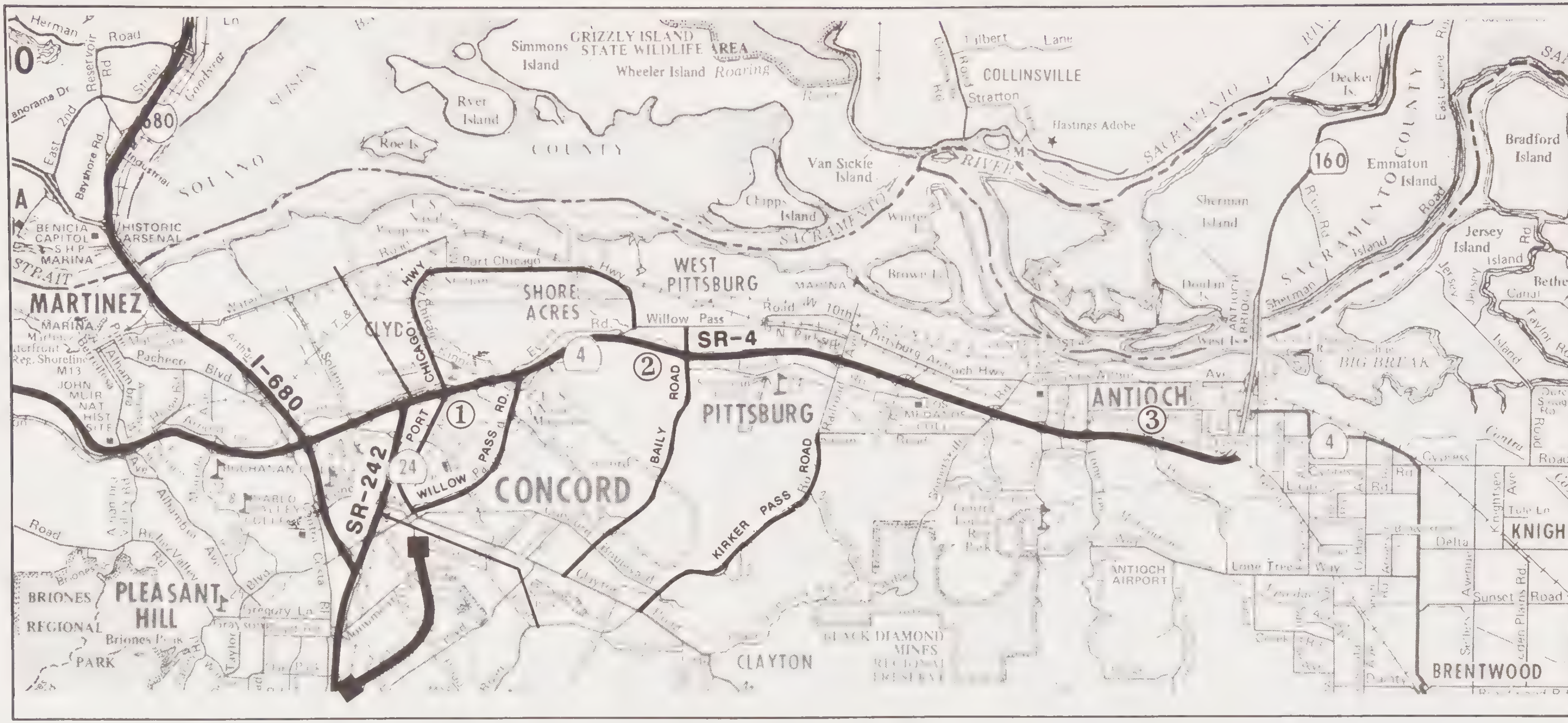
Legend

PITTSBURG–ANTIOCH CORRIDOR

North 0 2.5 5 MILES

BART

Exhibit 1.2-1



Legend

FREEWAYS

MAJOR ROADWAYS LINKS

① PARK-AND-RIDE FACILITIES

1. NORTH CONCORD/MARTINEZ
2. BAILY ROAD
3. HILLCREST AVENUE

EXISTING BART LINE

EXISTING BART CONCORD STATION

Existing Transportation Facilities

Pittsburg-Antioch Corridor AA/DEIR

North

0 1.5 3 MILES

BART

Exhibit 1.2-2

- Willow Pass Road: Two-lane arterial highway between State Route 4 and Concord with Level of Service F forecast by MTC in the year 2000.

- Bailey Road: Two-lane arterial highway between State Route 4 and Concord with Level of Service D forecast by MTC in year 2000.

- Kirker Pass Road: Two-lane arterial highway between State Route 4 and Concord with Level of Service C (average delay) in year 2000.

Existing Transit Service

Existing transit service in the corridor includes park-and-ride facilities and fixed-route bus lines. The Bay Area Rapid Transit District operates three park-and-ride facilities located (1) in North Concord/Martinez along the Port Chicago Highway, (2) in West Pittsburg at State Route 4 and Bailey Road, and (3) in Antioch at State Route 4 and Hillcrest Avenue. Express bus service is provided from the Concord BART Station to Martinez and to the Antioch-Brentwood area. The East Contra Costa Transit Authority operates four fixed-route bus lines in the eastern part of the county, and also dial-a-ride service.

1.2.2 TRANSPORTATION GOALS AND OBJECTIVES

A review of regional transportation goals and objectives, along with local priorities for effective public transportation, created an awareness of the need to approach transportation problems of the Pittsburg-Antioch Corridor in a truly multimodal (auto, bus, rail, walking, bicycle) fashion. The Pittsburg-Antioch transportation goals and objectives developed for the corridor support the comprehensive development of a multimodal transportation system.

Four major transportation planning goals have been adopted by the Board of Control. Each goal statement is accompanied by a brief description of its meaning and intent, followed by a list of objectives to be achieved. The goals are not listed in order of priority.

Goal 1: Improve Public Transportation Service to Increase Mobility

As rising population and income place greater pressure on existing services, improvements should be made to provide continued and improved access to employment, housing, commercial and recreational activities.

Objectives

- Increase the speed, comfort, and reliability of public transportation.
- Increase accessibility to activity centers and the region as a whole.
- Increase transit system ridership to relieve highway congestion.
- Provide mobility for transit dependents.
- Minimize adverse effects on the existing transportation system.

Goal 2: Provide Public Transportation Service Which is Financially Attainable

Public transportation should be viewed in light of financial resources likely to be available to initially implement and to make improvements over the life of the plan; and the level of services achieved per dollar expended.

Objectives

- Maximize operating efficiency.
- Minimize capital and operating costs.
- Maximize revenue and minimize subsidies.

Goal 3: Support Economic Expansion and Employment Opportunities

The transportation system should promote expansion of the corridor's productive capabilities and institutional resources.

Objectives

- Attract new residential, commercial, and industrial development.
- Enhance opportunities for public/private development partnerships.
- Increase opportunity for value capture.
- Increase tax receipts for local governments.
- Create jobs.

Goal 4: Improve the Environmental Quality

Transportation improvements should help to mitigate social and environmental problems. Where possible, they should enhance the environment and support existing land use plans.

Objectives

- Minimize negative air and noise impacts and energy consumption.
- Minimize displacement of homes and businesses.
- Insure compatibility with existing local and regional land use plans.
- Minimize impacts on parks, institutions, and historic buildings.
- Minimize neighborhood impacts.

1.2.3 GROWTH PROJECTIONS AND SPECIFIC TRANSPORTATION PROBLEMS IN THE CORRIDOR

During the next decades, east Contra Costa County, including the cities of Pittsburg, Antioch, and Brentwood, as well as the unincorporated communities of West Pittsburg, Oakley, Knightsen, Byron, and Discovery Bay, is expected to be one of the fastest-growing areas in the entire San Francisco Bay region. As the corridor population has grown, State Route 4, which links eastern Contra Costa County with employment centers, has become increasingly congested. During peak travel periods, State Route 4 between Willow Pass Road (west) in Concord and Willow Pass Road

(east) in West Pittsburg is at LOS F, exceeding the design capacity of the roadway. MTC projects that the number of daily commuters out of eastern Contra Costa County via the State Route 4 corridor will increase substantially from 23,600 in 1980 to 63,900 in 2000, or by 171 percent.

Future transportation demands in this corridor cannot be satisfied by highway improvements alone. Both highway and transit improvements are needed. Even if State Route 4 were widened from four to eight lanes, MTC estimates a LOS F by the year 2000. Furthermore, there is no present funding to expand State Route 4.

In addition, the terminus BART station in downtown Concord is not well located for access by corridor area residents. Typically Martinez, north Concord, and east Contra Costa County park-and-ride access patrons must travel either approximately 1 mile from State Route 242 or 2-1/2 miles from State Route 4 via congested local streets to reach the downtown Concord BART station. This congestion represents a major deterrent for residents of these areas to using BART. Expanding transit to the east would provide a more direct freeway access to mass transit facilities for corridor area residents and establish a much more efficient transit link between eastern Contra Costa County and the employment centers of central Contra Costa, Alameda, and San Francisco counties.

Access constraints at the terminus Concord Station are severe. During a typical weekday, the 1,912-space BART Concord Station parking lot fills by 6:40 a.m.; all available unrestricted onstreet parking within one-half mile of the station is occupied, and the Pittsburg-Antioch "P" Route BART express bus operates at 90-percent capacity during peak periods. An extension of transit to Antioch would alleviate Martinez, north Conc rd, and eastern Contra Costa County access demands at the BART Concord Station, thereby freeing parking and bus capacity for BART Concord residents in the BART Concord Station vicinity.

1.2.4 GOALS IMPORTANT IN SELECTION OF AN ALTERNATIVE

A review of goals and objectives from regional, county, and city planning documents provides a basis for evaluating alternatives and selecting a locally preferred alternative. In general, existing plans in the region can be viewed as forming a framework which embodies the overall goals of promoting and creating balanced communities, ensuring planned and orderly development, and protecting the natural environment.

Local and regional planning documents with stated goals and objectives for community and transportation development reveal a long list of objectives which range from very general to very specific. Planning documents reviewed included those for MTC, Contra Costa County, and the cities of Antioch, Brentwood, Concord, Martinez, and Pittsburg. In general, the following overall community goals are important in selecting a locally preferred alternative.

- Develop a sense of community through the development of safe, healthful, and attractive living environs.

- Provide and maintain employment centers appropriate to the corridor area and to aid in developing the economic base through new employment opportunities.

- Obtain maximum benefit from existing public facilities.

- Retain unique vegetation and wildlife areas adjacent to the water in the northern portion of the corridor in a natural condition.

The City of Concord transportation element of the General Plan has two main purposes: (1) to provide the basic structure around which the continuing development of the city will occur; and (2) to provide the basis for an ongoing program of street improvements. The objectives which relate to and support transit include:

- Facilitate access to transit stations, employment areas, and schools, and otherwise encourage a balanced transportation system which will stress suitable public transit modes.

- Locate land uses throughout the city in a pattern which facilitates transit service and reduces dependency on the private automobile.

The City of Pittsburg general and transportation/circulation policies concerning transit extension propose development of a balanced transportation system, including adequate provisions for public transit, pedestrians, and bicycles, as well as necessary facilities for the efficient circulation of vehicular traffic. Implementation programs designed to achieve these objectives include:

- Coordinate with the Bay Area Rapid Transit District and Caltrans in developing plans for implementing a transit right-of-way, needed interchanges, and bridges over State Route 4.

- Coordinate road system plans and designs with Contra Costa County and the City of Antioch to ensure that an adequate, well integrated overall transportation network is provided.

The circulation element of the General Plan for the City of Antioch states that "Any mass transit system and the various local support facilities, should each be designed and operated so as to protect and enhance the physical, economical, social, and ecological environment of the Antioch area." One of the specific policies of this element is to cooperate with Bay Area Rapid Transit District in the development of a transit line station within the city limits of Antioch.

1.3 PLANNING CONTEXT

1.3.1 THE PLANNING AND PROJECT DEVELOPMENT PROCESS

A final report on the Pittsburg-Antioch BART extension project was completed in 1976. However, since that time, central and eastern Contra Costa County, including Concord, Martinez, West Pittsburg, Pittsburg, Antioch, Oakley, and Brentwood, have experienced significant growth patterns different from those forecast in the mid-1970s. As a result of changes in growth, new land use patterns, State Route 4 improvements, and transportation service requirements, in 1981 the Bay Area Rapid Transit District conducted the Aerial/At-Grade Alignment Feasibility Study Along State Route 4 for the Pittsburg-Antioch Extension. At the conclusion of the study the District Board of Directors adopted a preferred route alignment heading northward from the existing BART Concord Station along the abandoned Sacramento Northern Railroad line and paralleling Port Chicago Highway to State Route 4, then eastward along State Route 4 to West Pittsburg, Pittsburg, and Antioch. Stations were proposed in North Concord, West Pittsburg, Pittsburg, West Antioch, and East Antioch.

The Pittsburg-Antioch Corridor AA/EIR is a continuation of the process of evaluating alternatives. Eleven potential transit alternatives were originally identified for study. The alternatives covered three basic transit modes: bus (express and local service), light rail transit (LRT), and BART. Through the scoping process, including the public meeting held on January 28, 1987, and preliminary environmental and feasibility screening, the number of alternatives to receive rigorous examination in the AA/EIR was first reduced to focus on the most promising options. Subsequently, shortened segments or Minimum Fundable Segment (MFS) options have been added to the study.

1.3.2 ROLE OF THE EIR IN PROJECT DEVELOPMENT

The primary role of the EIR is to document the environmental effects of alternative transit modes and alignment options. It is intended to be a full disclosure, informational document for use by the Board of Control in Selecting a preferred alternative.

Because the document was originally intended to be a joint EIR/EIS, the technical analysis was prepared according to the guidelines of CEQA (Public Resources Code Section 21000 et seq.) and the State CEQA Guidelines Section 15000 et seq., as well as following the general guidelines of 40 CFR Part 1500, Council on Environmental Quality, Regulations for Implementing the Procedural Requirements of the National Environmental Policy Act (NEPA) of 1969 as amended; and 49 CFR Part 622, Federal Highway Administration and Urban Mass Transportation Administration, Environmental Impact and Related Procedures.

An active citizen participation program is being conducted over the course of the entire study. The objectives of the community participation activities are to (1) give members of the general public early opportunities to identify issues of major concern that pertain to the public transportation improvements in the Pittsburg-Antioch Corridor; (2) provide information to the study team about current public attitudes and concerns; and (3) accomplish an agency and public scoping process that ensures

early and efficient input regarding issues and analytic requirements from applicable federal, state, and local agencies and the interested public.

Environmental impacts subject to analysis include a full range of potentially significant environmental issues, such as changes in the natural and social environments, impacts on parklands and historic sites, changes in transit service and patronage, associated changes in highway congestion, capital costs, operating and maintenance costs, and financial implications. The evaluation criteria used in the AA/EIR for the various alternatives include transportation, environmental, social, and financial factors as directed by current federal (NEPA) and state (CEQA) environmental laws and UMTA guidelines. Measures are explored to mitigate any significant adverse impacts that are identified, along with quantification of the costs and effectiveness of such measures.

1.3.3 DECISION AT HAND TO SELECT A LOCALLY PREFERRED ALTERNATIVE

This AA/EIR has been prepared specifically to provide the interested public, reviewing agencies, and the decision makers in Contra Costa County with the information necessary to make an informed choice as to the transportation investment most appropriate for the Pittsburg-Antioch Corridor. During circulation of this document, the Bay Area Rapid Transit District will hold a public hearing to receive comments on the document. The Board of Control subsequently will select a locally preferred alternative. This recommendation, and a recommendation on certification of the EIR, will be presented to the District Board of Directors for its approval.

The Board of Control guiding the AA/EIR is chaired by a representative of the Bay Area Rapid Transit District Board of Directors. Other Board of Control members are the mayors or councilpersons of the cities of Concord, Martinez, Pittsburg, Antioch, and Brentwood; and representatives from Contra Costa County, East Contra Costa Transit Authority, Caltrans, and the MTC. In addition, a Technical Advisory Committee provides technical support for the study. The Technical Advisory Committee consists of staff from the cities of Concord, Martinez, Pittsburg, Antioch, and Brentwood; Contra Costa County, the Bay Area Rapid Transit District, Tri-Delta Transit, Caltrans, the Metropolitan Transportation Commission, the U.S. Naval Weapons Station in Concord; and the Southern Pacific, Union Pacific, and Santa Fe railroads.

The overall study effort will conclude with the selection of a locally preferred alternative. The analytical work in the AA/EIR is intended to be a rigorous examination of a small number of transportation modes and alignment options so that a choice of a locally preferred alternative can be based on reliable cost and environmental impact information.

SECTION 2

ALTERNATIVES CONSIDERED

2.1 SCREENING AND SELECTION PROCESS

Three primary public transportation alternative modes have been evaluated, including busway/high occupancy vehicle (HOV) lanes, light rail transit (LRT), and rapid rail transit (BART). Key characteristics of each mode are described below.

2.1.1 BUSWAY/HIGH OCCUPANCY VEHICLE (HOV) LANES

Busway/HOV lanes are new highway lanes that are reserved for vehicles carrying three or more persons (buses, vanpools, and carpools). In some locations these vehicles will be given preferential access to the HOV lane via ramps reserved exclusively for HOV use. Park-and-ride lots will be located along the HOV facility, with express buses operating nonstop from the park-and-ride lot to the primary destination.

There are numerous examples of HOV lanes throughout the United States, including those on the San Bernardino Freeway in the Los Angeles area and the Shirley Highway in northern Virginia. These two examples are most similar to the HOV alternative concept in State Route 4 in the Pittsburg-Antioch Corridor.

2.1.2 LIGHT RAIL TRANSIT (LRT)

LRT is an urban transportation mode that can operate on a semi-exclusive right-of-way with at-grade intersections, or on a totally exclusive right-of-way. Trains comprising one to four vehicles are electrically propelled from an overhead wire. Stations are proposed to be modest structures with passenger loading to and from trains accomplished from high-level platforms. A barrier-free fare collection system is proposed, whereby patrons purchase their own tickets and spot checking is done by roving ticket checkers. Examples of LRT systems include MUNI in San Francisco, MTDB in San Diego, and MBTA in Boston.

2.1.3 RAPID RAIL TRANSIT (BART)

The BART alternative would be an extension of the present BART system, with no significant design changes planned. BART is an urban passenger transportation system employing electrically propelled vehicles on an exclusive and fully grade-separated right-of-way. Electric power is conducted by a "third rail" so there is no visible overhead wire.

Efficient passenger loading is provided by multiple, wide automatic doors, high level platforms, and in-station fare collection. High cruising speeds, station spacings averaging approximately 2 miles, and absence of conflicts with auto traffic allow for relatively high schedule speeds. Examples include the WMATA in Washington, DC, and MARTA in Atlanta, as well as BART.

2.1.4 ALTERNATIVES CONSIDERED

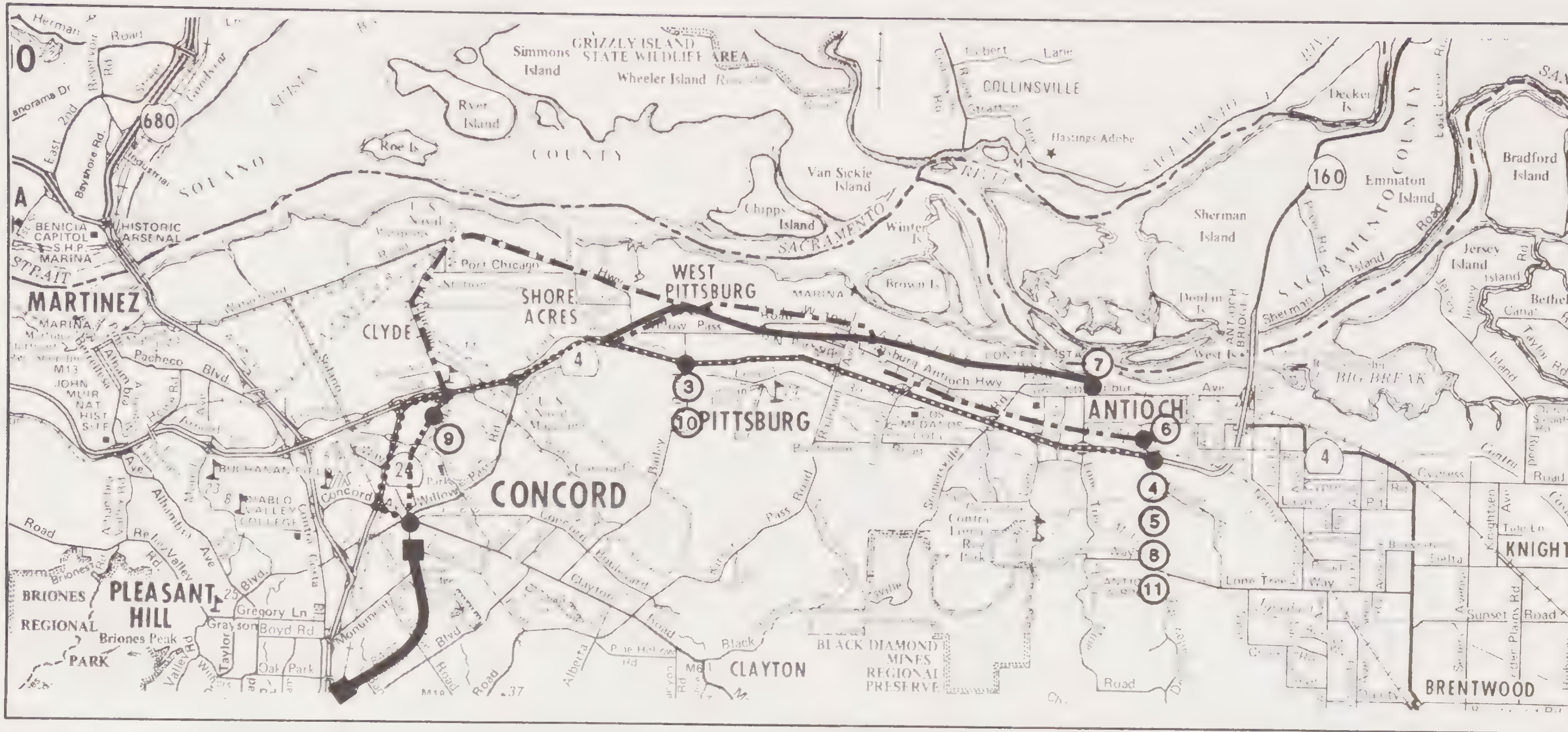
Previous studies have examined a wide range of mode and alignment alternatives in the Pittsburg-Antioch Corridor, including the Final Report: Pittsburg-Antioch BART Extension Project (Pittsburg-Antioch BART Extension Board of Control 1976), the Draft Eastern Contra Costa Light Rail Transit Study (Tri-Delta Transit/BARTD 1981), the Aerial/At-Grade Alignment Feasibility Study Along State Route 4 for the BART Pittsburg-Antioch Extension (BARTD 1981); and the Metropolitan Transportation Commission, draft I-680/I-580 Corridors Study (MTC 1988). Based on the results of these studies, the public scoping process, and considerations by the Board of Control and Technical Advisory Committee who oversee this study, the 11 alternatives listed in Table 2.1-1 were initially selected for additional study.

TABLE 2.1-1

INITIAL 11 TRANSPORTATION ALTERNATIVES

Alternative 1	- No Build (Existing System and Programmed Improvements)
Alternative 2	- Transportation Systems Management (TSM)
Alternative 3	- High Occupancy Vehicle (HOV) Lanes to West Pittsburg
Alternative 4	- HOV Lanes to Antioch
Alternative 5	- Light Rail Transit (LRT) to Antioch Via State Route 4
Alternative 6	- LRT to Antioch Via Sacramento Northern Railroad & Southern Pacific Transportation Company (SPTC) Right-of-Way
Alternative 7	- BART to North Concord/Martinez; LRT to Antioch Via State Route 4 and Santa Fe Railroad
Alternative 8	- BART to North Concord/Martinez; LRT to Antioch Via State Route 4
Alternative 9	- BART to North Concord/Martinez
Alternative 10	- BART to West Pittsburg Via State Route 4
Alternative 11	- BART to Antioch Via State Route 4

A map of the initial alternatives listed in Table 2.1-1 is shown in Exhibit 2.1-1.



Legend

HOV LANE ALIGNMENT–ALTERNATIVE 3, 3A, 4

PORT CHICAGO HIGHWAY/STATE ROUTE 4 ALIGNMENT–ALTERNATIVES 5,8,9,10,11

SACRAMENTO NORTHERN ALIGNMENT–ALTERNATIVE 6

SANTA FE ALIGNMENT–ALTERNATIVE 7

EXISTING BART LOCATIONS OR PARK-AND-RIDE LOT

EXISTING BART LINE

(4) TERMINUS OF ALTERNATIVE

Initial Eleven Transportation Alternatives

Pittsburg–Antioch Corridor AA/DEIR

North

0 1.5 3 MILES

BART

Exhibit 2.1–1

2.1.5 SCREENING PROCESS

A preliminary evaluation was performed on each of the eleven alternatives listed in Table 2.1-1, which considered transportation service characteristics, ridership forecasts, transportation impacts, environmental issues, costs, revenues, goals and objectives, and long range considerations. Based on this preliminary evaluation, the list of 11 alternatives was narrowed to 7 by the Board of Control in May 1987. Key findings for each of the eleven alternatives are listed below.

Alternatives To Be Studied Further

- Alternative 1 (No Build [Existing System and Programmed Improvements]) - This alternative is required for evaluation in the EIR.

- Alternative 2 (Transportation Systems Management) - This alternative is required for evaluation in the EIR.

- Alternative 4 (HOV Lanes to Antioch) - This is the lowest-capital-cost alternative that could provide a high level of transportation service to Antioch. It carries the HOV mode over the entire length of the corridor.

- Alternative 5 (LRT to Antioch via State Route 4) - This is the lowest cost rail alternative extending to Antioch. It provides LRT service over the entire length of the corridor.

- Combination of Alternatives 5, 6, and 7 (LRT to Antioch via State Route 4 and Southern Pacific Transportation Company Right-of-Way) - This alternative would take LRT from the existing BART station in Concord along Port Chicago Highway to State Route 4. The line would turn east into State Route 4 and extend to the Willow Pass East interchange. Here the line would turn northeast through West Pittsburg and enter the SPTC right-of-way. It would then extend along the SPTC to Hillcrest Avenue in Antioch. This alternative, therefore, takes the LRT mode over the entire length of the corridor and makes primary use of a railroad right-of-way that is relatively well located in the corridor.

- Alternative 9 (BART to North Concord/Martinez) - This alternative would relocate the BART terminal station out of downtown Concord and to a point where major highway accessibility is excellent. Also, the potential exists for an intermodal transfer station at this location.

- Alternative 11 (BART to Antioch via State Route 4) - This alternative carries the BART mode over the entire length of the corridor.

Alternatives To Be Dropped From Further Study

- Alternative 3 (HOV Lanes to West Pittsburg) - This alternative is a subset of Alternative 4 (HOV Lanes to Antioch). Alternative 3 could still be considered as a "stage 1" project if Alternative 4 were selected as the locally preferred alternative.

- Alternative 6 (LRT to Antioch via SNRR & SPTC) - This alternative crosses the U.S. Naval Weapons Station and its implementation would affect existing wetlands, place transit patrons within explosive safety buffer zones, and result in security risks for weapons station operations. The U.S. Navy's requirement for a 2.2-mile blast-proof structure through the weapons station drives the capital cost of this alternative above that of the LRT alternatives which traverse Willow Pass grade. The three additional route miles for this alternative cause the travel time to be 25 percent greater than for other LRT alternatives. Station siting is poor due to the waterfront location, which also causes parking problems in Pittsburg as well as traffic accessibility problems. Also, this line is subject to flooding in the U.S. Naval Weapons Station area.

- Alternative 7 (BART to North Concord/Martinez; LRT to Antioch via State Route 4 and SFRR) - The Preferred Alternative may be any one or a combination of the seven alternatives suggested for further study. Therefore, it is not required to evaluate a specific BART/LRT combined alternative. Also, the SFRR alignment between Pittsburg and Antioch is poorly located from a patronage point of view; would result in severe parking and negative transportation impacts; is incompatible with Antioch's land use in the Waterfront area; and presents poor opportunities for an extension beyond Antioch towards Oakley and Brentwood.

- Alternative 8 (BART to North Concord/Martinez; LRT to Antioch via State Route 4) - This alternative is covered by Alternatives 5 and 9.

- Alternative 10 (BART to West Pittsburg via State Route 4) - This alternative is covered by Alternative 11.

In April 1988, the Board of Control selected five intermediate terminal locations for some of the longer-length alternatives to be studied as "minimum fundable segments." The result was 12 final alternatives that were evaluated in detail and addressed in this AAEIR. They are listed in Table 2.1-2 and shown on Exhibit 2.1-2.

2.2 DEFINITION OF ALTERNATIVES

Following is a description of each of the 12 alternatives evaluated.

2.2.1 ALTERNATIVE 1 (NO BUILD)

This alternative consists of existing and programmed highway and transit system improvements described in the current State Transportation Improvement Plan (STIP) and 5-year transit plans.

The "no build" alternative includes the following features:

- BART: Reduction of peak headways on the Concord line from 7.5 minutes to 4.5 minutes.

Legend

HOV LANE ALIGNMENT – ALTERNATIVE 3, 3A

PORT CHICAGO HIGHWAY/
STATE ROUTE 4 ALIGNMENT – ALTERNATIVES 4, 4A, 6, 7, 7A, 7B, AND 8

SOUTHERN PACIFIC TRANSPORTATION
COMPANY ALIGNMENT – ALTERNATIVE 5

STATION LOCATIONS

EXISTING BART LINE

4 TERMINUS OF ALTERNATIVE

NOTE: 1 – NO BUILD
2 – TSM

Final Twelve Transportation Alternatives
Pittsburg-Antioch Corridor
AA/DEIR

North

0 1.5 3 MILES

BART

Exhibit 2.1–2

TABLE 2.1-2

FINAL 12 TRANSPORTATION ALTERNATIVES

Alternative 1	-	No Build (Existing System and Programmed Improvements)
Alternative 2	-	Transportation Systems Management (TSM)
Alternative 3	-	Busway/High Occupancy Vehicle (HOV) Lanes to Antioch
Alternative 3A	-	Busway/High Occupancy Vehicle (HOV) Lanes to Pittsburg
Alternative 4	-	Light Rail Transit (LRT) to Antioch via State Route 4
Alternative 4A	-	Light Rail Transit (LRT) to West Antioch via State Route 4
Alternative 5	-	Light Rail Transit (LRT) to Antioch via State Route 4 and Southern Pacific Transportation Company (SPTC) Right-of-Way
Alternative 6	-	BART to North Concord/Martinez
Alternative 7	-	BART to Antioch via State Route 4
Alternative 7A	-	BART to West Pittsburg via State Route 4
Alternative 7B	-	BART to Pittsburg via State Route 4
Alternative 8	-	BART to North Concord/Martinez; Light Rail Transit (LRT) to West Antioch via State Route 4

- Tri-Delta Transit: More frequent headways on the three routes in the system, with extension of one route to southeast Antioch.

- County Connection: Existing routes and headways.

- BART Express Bus: Slight alignment changes to eight-route system with existing headways and Route P operating primarily on State Route 4.

- State Route 4: Existing highway configuration, plus an additional westbound lane over Willow Pass Grade.

- I-680: Addition of one to two lanes in both directions between Martinez and the Alameda/Contra Costa County line.

Existing services and programmed improvements from this alternative are included in all subsequent alternatives with appropriate modifications.

Exhibit 2.2-1 shows the BART rail service included in Alternatives 1 and 2, and Exhibit 2.2-2 shows the terminals for express bus service for the alternatives.

2.2.2 ALTERNATIVE 2 (TSM)

This alternative consists of the following low-cost measures intended to enhance transportation performance and increase auto occupancy in the corridor:

- BART Express Bus:
  - Addition of park-and-ride facilities near Somersville Road and Railroad Avenue in Pittsburg
  - Provision of 10-minute headways during morning and afternoon two-hour peaks
- County Connection:
  - Modification and addition of selected routes to provide express service in addition to local service
  - Reduction of some peak and off-peak headways
- Tri-Delta Transit:
  - Provision of subscription-type express bus service from Antioch and Pittsburg to Bishop Ranch, Hacienda Business Park, and Lawrence Livermore Laboratory.

The above transit improvements are included in all subsequent alternatives with modifications to serve BART extension stations, LRT stations, or park-and-ride lots.

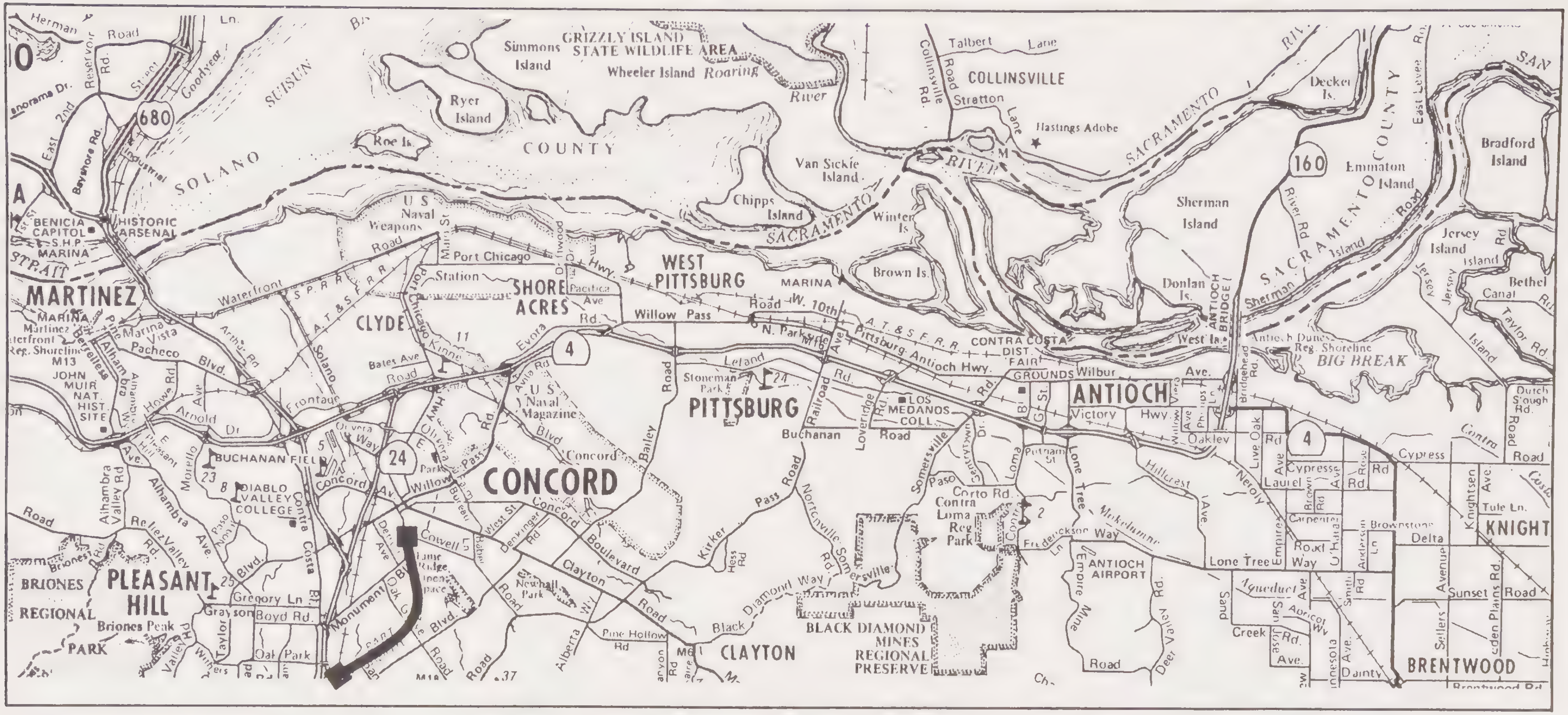
2.2.3 ALTERNATIVE 3 (BUSWAY/HIGH OCCUPANCY VEHICLE [HOV] LANES TO ANTIOCH, 16.4 MILES)

Beginning at the State Route 242 interchange, new lanes would be built in the median of Route 4 east to Hillcrest Avenue in Antioch, with exclusive ramps for buses and HOV lanes provided to serve park-and-ride facilities.

Exhibit 2.2-3 shows that express buses would travel on a widened section of Concord Avenue north from the BART station to State Route 242 and then continue on that widened freeway before reaching the HOV lanes on State Route 4. Buses would operate at peak intervals of 10 minutes.

2.2.4 ALTERNATIVE 3A (BUSWAY/HIGH OCCUPANCY VEHICLE [HOV] LANES TO PITTSBURG, 10.3 MILES)

Same as Alternative 3 except that busway/high occupancy lanes terminate at Railroad Avenue in Pittsburg.



=BART Rail Service

=BART Station

NOTE: BART Express Bus routes shown in **Exhibit 2.2-2**
Tri-Delta & County Connection Bus Routes
NOT shown.

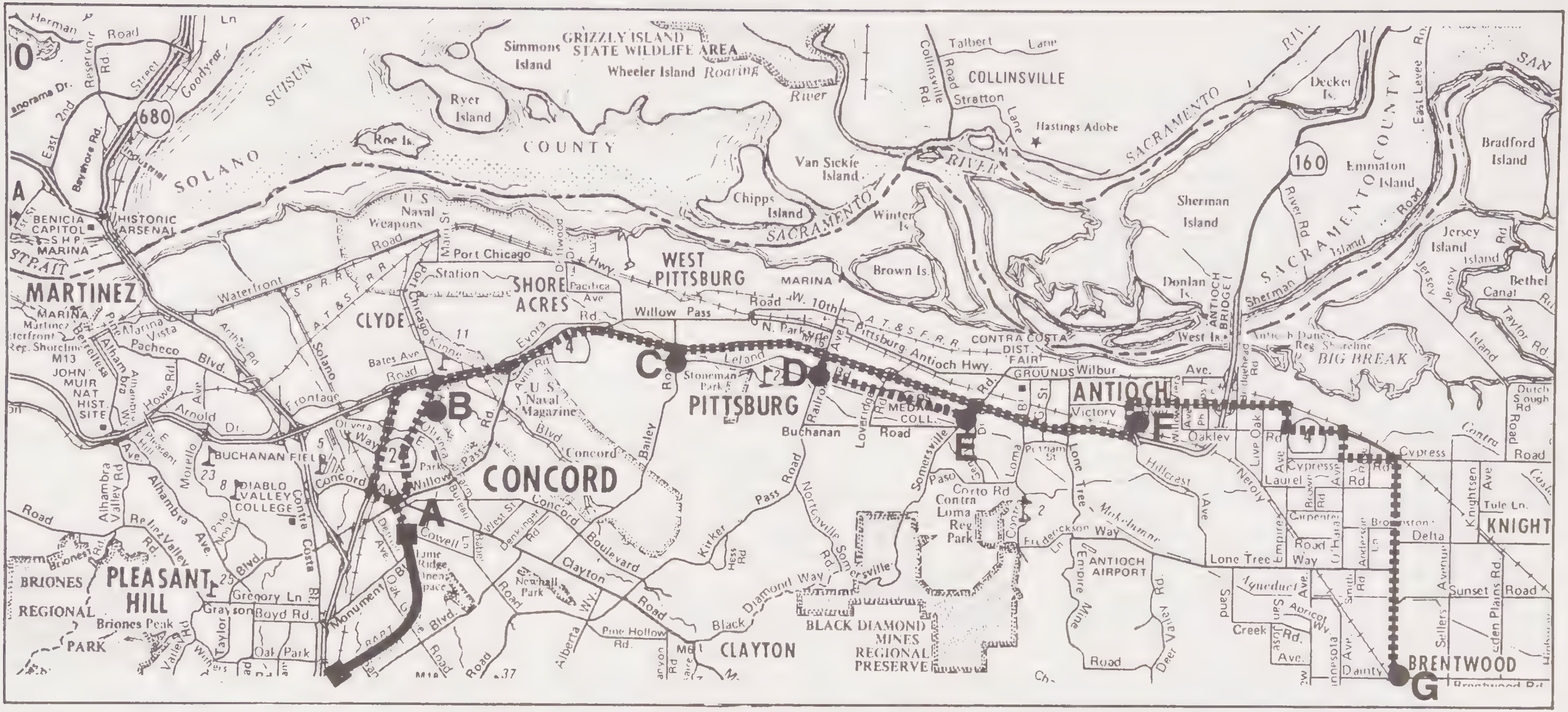
Alternatives 1 (No Build) and 2 (TSM)

Pittsburg-Antioch Corridor AA/DEIR

North 0 1.5 3 MILES

BART

Exhibit 2.2-1



BART/EXPRESS ROUTES

ALTERNATIVE 1: Concord-Brentwood (A-G)

ALTERNATIVES 2 & 3:
- Concord-Bailey Park & Ride (A-C)
- Concord-Railroad Park & Ride (A-D)
- Concord-Somersville Park & Ride (A-E)
- Concord-Hillcrest Park & Ride (A-F)
- Concord-Brentwood (A-G)

ALTERNATIVES 4,5 & 7: Antioch-Brentwood (F-G)

ALTERNATIVE 6: North Concord-Antioch (B-F)
North Concord-Pittsburg (B-D)

▬▬ =BART Rail Service
■ =BART Station
▪▪▪▪▪ =Express Bus Routes
● =BART Express Bus Terminal

Note: Only peak-hour routes shown.

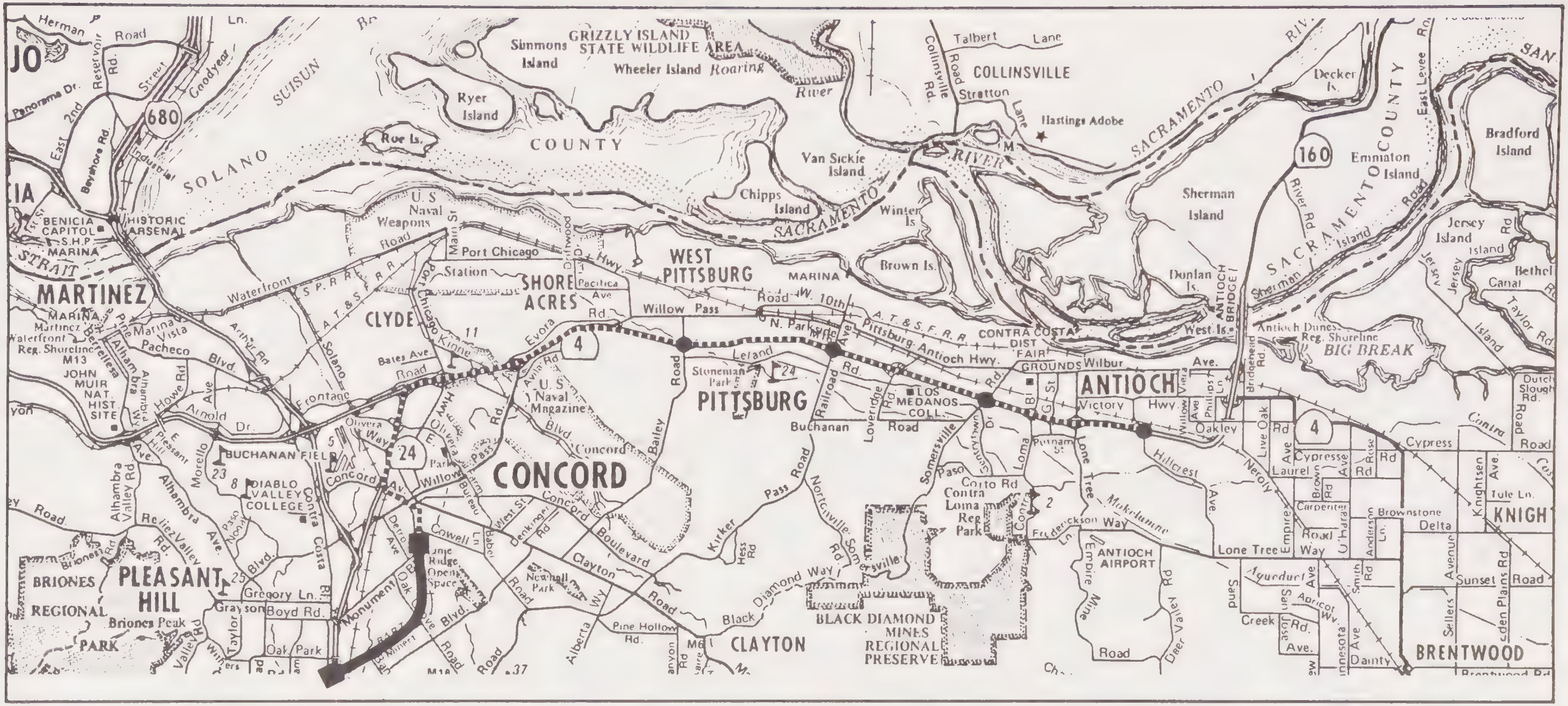
Express Bus Service Terminals by Alternative

Pittsburg-Antioch Corridor AA/DEIR

North 0 1.5 3 MILES

BART

Exhibit 2.2-2



=BART Rail Service

=BART Station

=Alignment Followed by Express Buses, Exclusive Lanes on SR-4

=Access/Egress Points to Freeway HOV Lanes

Minimum Fundable Segment:
3A– Terminal @ Railroad Av. (Pittsburg)

Alternatives 3 (HOV to Antioch) and 3A (HOV to Pittsburg)

Pittsburg–Antioch Corridor AA/DEIR

North 0 1.5 3 MILES

Exhibit 2.2-3

2.2.5 ALTERNATIVE 4 (LIGHT RAIL TRANSIT [LRT] TO ANTIOCH VIA STATE ROUTE 4, 16.7 MILES)

Beginning at the Concord BART station, LRT trains would operate at peak intervals of 7.5 minutes on double tracks located along Port Chicago Highway to State Route 4, and east in the median of State Route 4 to Hillcrest Avenue. (See Exhibit 2.2-4.)

2.2.6 ALTERNATIVE 4A (LIGHT RAIL TRANSIT [LRT] TO WEST ANTIOCH VIA STATE ROUTE 4, 12.6 MILES)

Same as Alternative 4, except LRT trains terminate at the Somersville Road park-and-ride lot in Pittsburg, and an LRT maintenance yard is planned in Pittsburg at the northeast corner of State Route 4 and Loveridge Road.

2.2.7 ALTERNATIVE 5 (LIGHT RAIL TRANSIT [LRT] TO ANTIOCH VIA STATE ROUTE 4 AND SOUTHERN PACIFIC TRANSPORTATION COMPANY [SPTC] RIGHT-OF-WAY, 16.2 MILES)

Beginning at the Concord BART station, LRT trains would operate at peak intervals of 7.5 minutes on double tracks located along Port Chicago Highway to State Route 4, then east on State Route 4 to Willow Pass Road, then on Willow Pass Road east and north to the Southern Pacific railroad line at Bailey Road, and then east to Hillcrest Avenue in Antioch. (See Exhibit 2.2-5.)

2.2.8 ALTERNATIVE 6 (BART TO NORTH CONCORD/MARTINEZ, 2.3 MILES)

BART tracks would be extended north to a new station at the North Concord/Martinez park-and-ride. BART trains would operate at peak headways of 4.5 minutes. (See Exhibit 2.2-6.)

2.2.9 ALTERNATIVE 7 (BART TO ANTIOCH VIA STATE ROUTE 4, 16.2 MILES)

BART tracks would be extended from the Concord station north along Port Chicago Highway to State Route 4 and then east in the median of State Route 4 to Hillcrest Avenue in Antioch. BART trains would operate at peak headways of 4.5 minutes. (See Exhibit 2.2-7.) This alternative also includes a 900-foot south yard lead within the existing BART maintenance facility south of the Concord BART Station. The south yard lead would be used in peak periods of service to change train lengths and take trains in and out of service from the Concord line.

2.2.10 ALTERNATIVE 7A (BART TO WEST PITTSBURG VIA STATE ROUTE 4, 7.1 MILES)

Same as alternative 7, except BART trains terminate at Bailey Road in West Pittsburg.

2.2.11 ALTERNATIVE 7B (BART TO PITTSBURG VIA STATE ROUTE 4, 10.1 MILES)

Same as Alternative 7, except BART trains terminate at Railroad Avenue in Pittsburg.

2.2.12 ALTERNATIVE 8 (BART TO NORTH CONCORD/MARTINEZ; LIGHT RAIL TRANSIT (LRT) TO WEST ANTIOCH VIA STATE ROUTE 4, 12.6 MILES)

A combination of Alternatives 6 and 4A, with BART to North Concord/Martinez and LRT from North Concord/Martinez to the Somersville Road park-and-ride lot in Pittsburg. In addition, an LRT maintenance yard is planned in Pittsburg at the northeast corner of State Route 4 and Loveridge Road.

2.3 CAPITAL COSTS

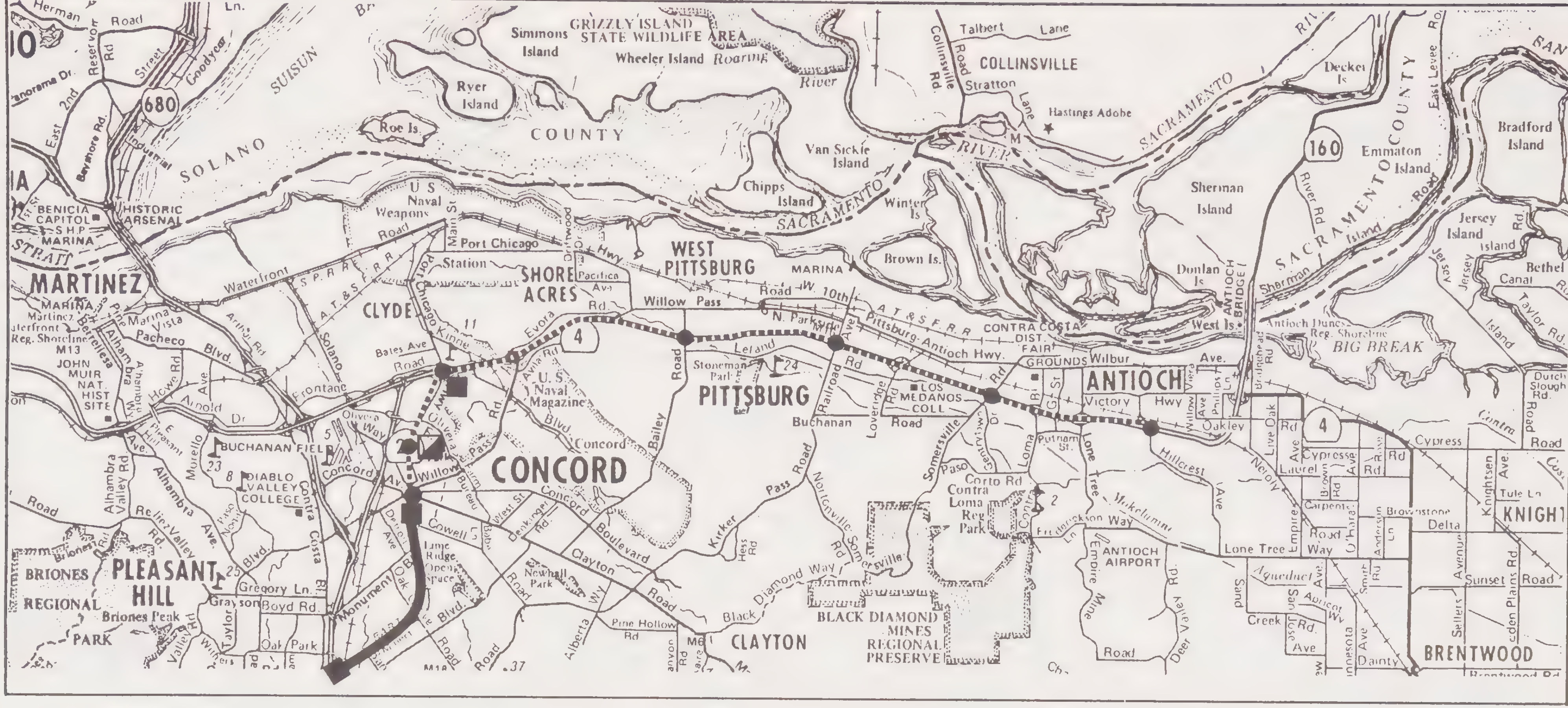
Capital cost estimates have been prepared to construct each of the 12 alternatives. The estimates are intended to be inclusive of all costs to fully implement the particular alternative, including right-of-way, guideway, stations, yards, and shops; rebuilding of State Route 4 or any other facilities that require modification to accommodate transit; providing trains and/or buses to operate the proposed transit services; engineering and management services; and a contingency allowance. The costs have been developed based on conceptual engineering drawings prepared for each alternative, the transit patronage and operating plan developed for each alternative, and unit construction costs prepared specifically for the type of work that will be required to implement each alternative. A summary of the estimated construction costs for each alternative is shown in Table 2.3-1.

2.4 OPERATING AND MAINTENANCE COSTS

Operating and maintenance cost estimates have been prepared for each alternative based on the transit service that is forecast to be provided in the year 2000. The estimated costs are based on services provided by four separate transit operations in the corridor:

- Eastern Contra Costa Transit Authority (ECCTA or Tri-Delta Transit)
- Central Contra Costa Transit Authority (CCCTA or County Connection)
- BART Express Bus
- BART Train Service

To estimate the operating and maintenance costs, cost models were prepared for each of these four operations. The model predictions were then validated against actual operating costs today. Statistics for transit operations in the year 2000 were then used as inputs to the model for each alternative, including such items as vehicle requirements, annual vehicle miles, and annual vehicle/train hours. The resulting operating and maintenance cost forecasts, which have been reviewed by each of the transit operators, are summarized in Table 2.4-1.



=BART Rail Service
=BART Station
=Light Rail Transit Station
=Alignment Followed by BART/LRT
=LRT Station ONLY, Not BART Station

Minimum Fundable Segments:
4A- LRT Terminal @ Somersville Rd. (W. Antioch);
8- BART to N. Concord, LRT to W. Antioch

Alternatives 4 (LRT to Antioch), 4A (LRT to West Antioch), and 8 (Bart/LRT Combination).

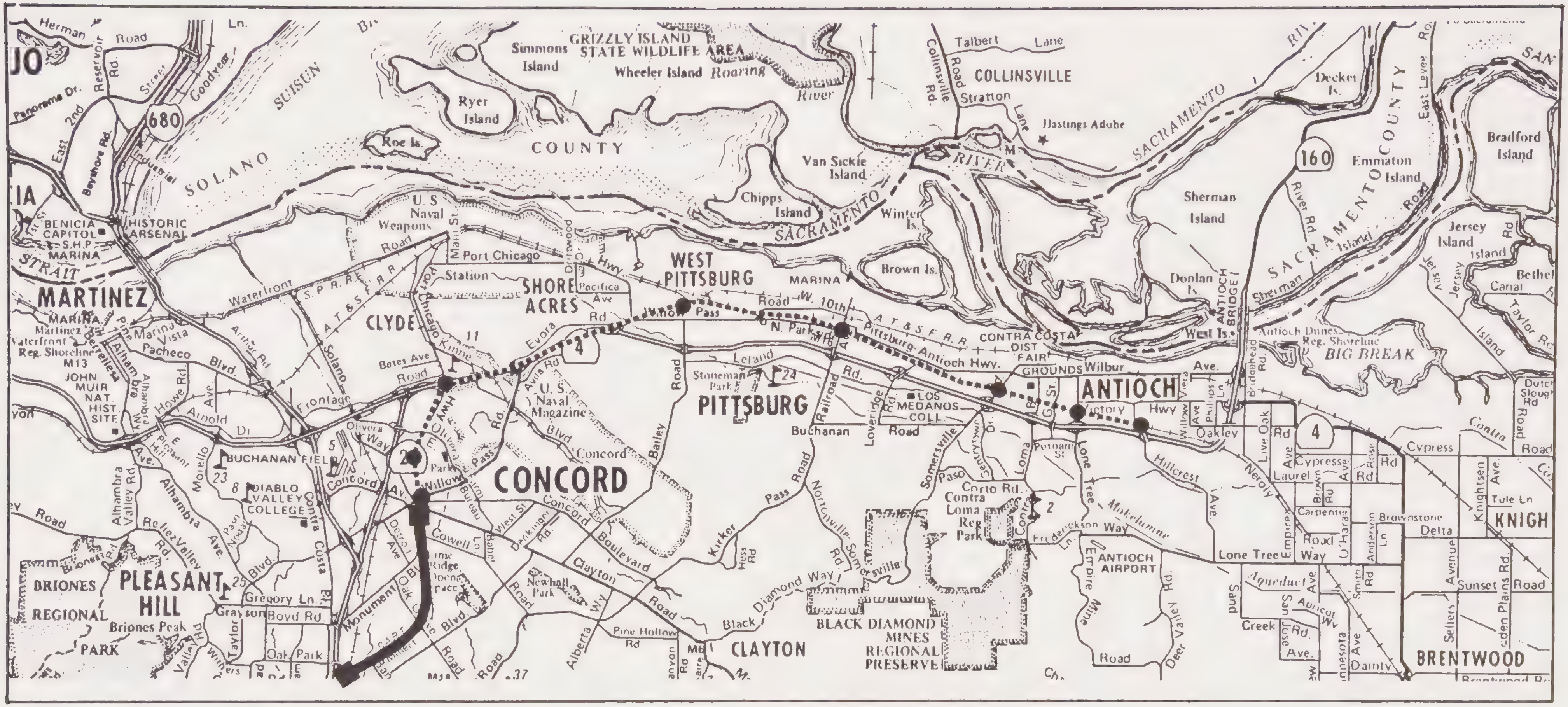
Pittsburg-Antioch Corridor AA/DEIR

North

0 1.5 3 MILES

BART

Exhibit 2.2-4



▬▬ =BART Rail Service

■ =BART Station

······· =Alignment Followed by LRT

● =Light Rail Transit Station

Alternative 5 (LRT to Antioch via SPTC)

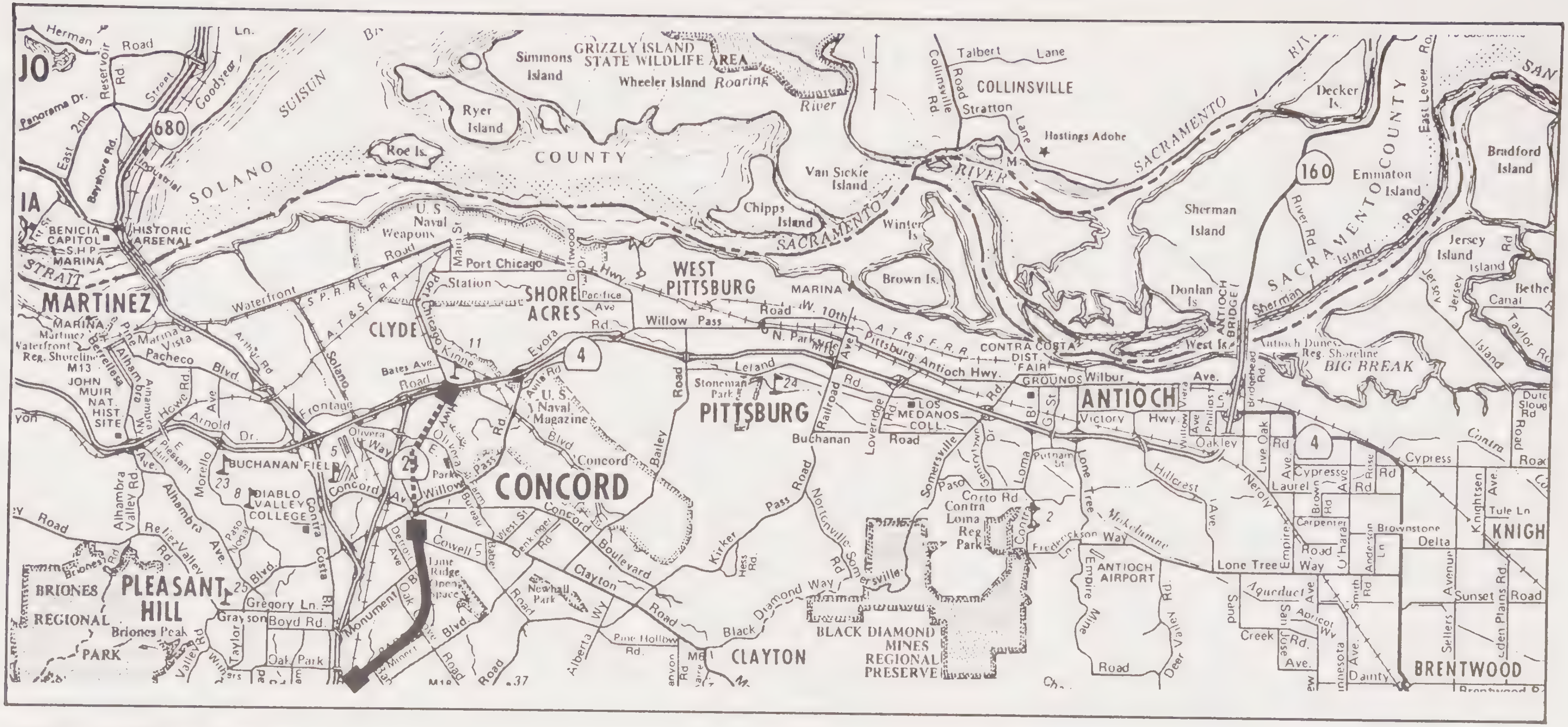
Pittsburg–Antioch Corridor AA/DEIR

North

0 1.5 3 MILES

BART

Exhibit 2.2-5



=BART Rail Service
=BART Station
=Alignment Followed by BART

Alternative 6 (Bart to North Concord/Martinez)

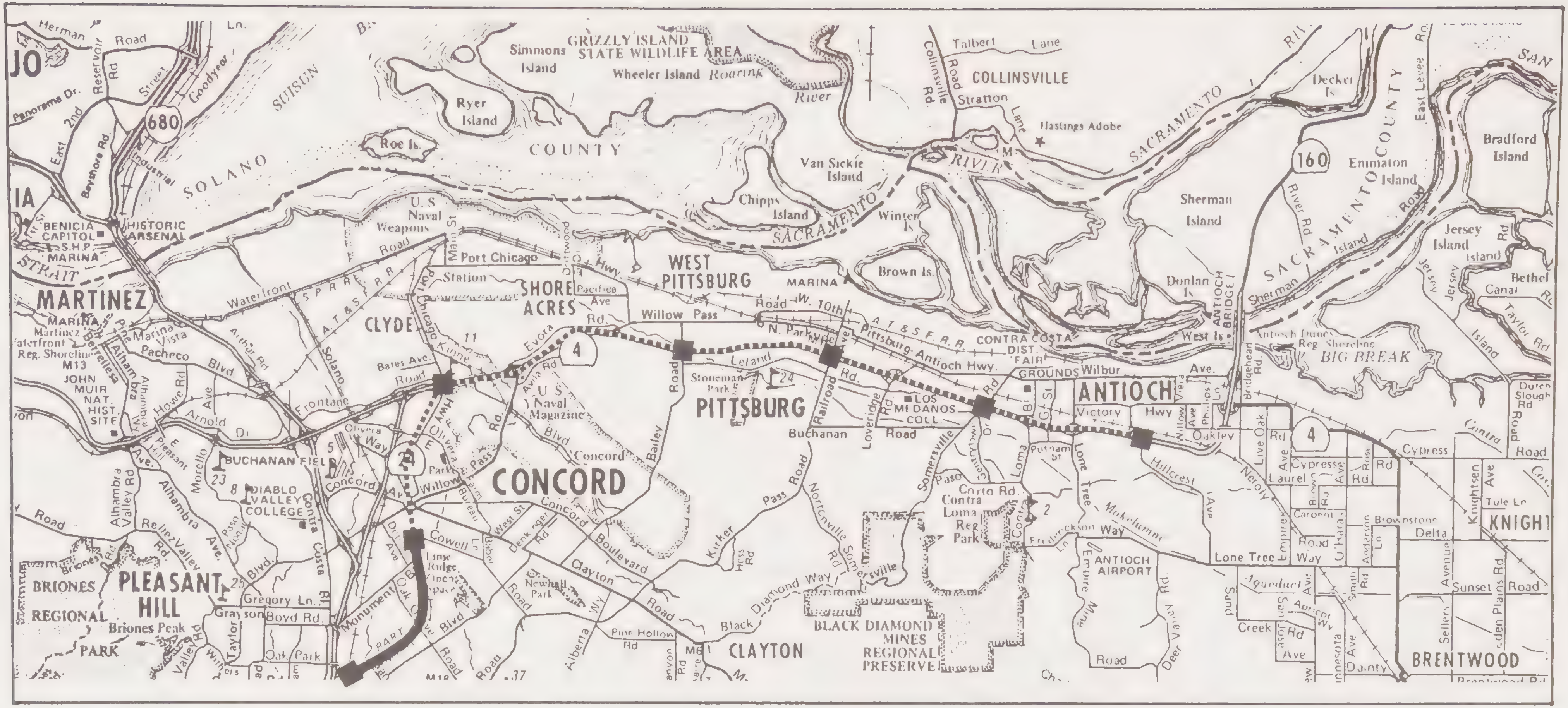
Pittsburg–Antioch Corridor AA/DEIR

Note: BART Express Bus Routes shown in Fig 2.2-2
Tri-Delta & County Connection
Bus Routes NOT shown.

North 0 1.5 3 MILES

BART

Exhibit 2.2-6



=BART Rail Service

=BART Station

=Alignment Followed by BART

Minimum Fundable Segments:

7A–Terminal @ Bailey Rd. (W. Pittsburg)

7B–Terminal @ Railroad Av. (Pittsburg),

Alternatives 7 (Bart to Antioch), 7A (Bart to West Pittsburg), and 7B (Bart to Pittsburg)

Pittsburg–Antioch Corridor AA/DEIR

North 0 1.5 3 MILES

BART

Exhibit 2.2-7

TABLE 2.3-1

CAPITAL COST ESTIMATES BY ALTERNATIVE
(1987 DOLLARS)

Item	Cost Estimate (000's)											
	ALT 1	ALT 2	ALT 3	ALT 3A	ALT 4	ALT 4A	ALT 5	ALT 6	ALT 7	ALT 7A	ALT 7B	ALT 8
1.0 Segments	0	120	120,562	78,945	225,287	172,436	222,198	62,777	252,452	113,608	171,948	192,674
2.0 Systemwide:												
Electrification, Signaling, Communication	0	0	0	0	31,817	25,154	32,702	20,441	107,761	51,005	70,078	41,089
Vehicles	0	0	0	0	28,500	24,000	28,500	16,500	43,500	25,500	34,500	37,500
Yard and Maintenance Facility	0	0	0	0	13,650	13,650	13,650	5,720	20,400	8,840	11,960	19,370
Subtotal	**0**	**0**	**0**	**0**	**73,967**	**62,804**	**74,852**	**42,661**	**171,661**	**85,345**	**116,538**	**97,959**
3.0 Engineering and Construction Management 20% (of 1.0 + 2.0)	0	24	24,112	15,789	59,851	47,048	59,410	21,088	84,823	39,791	57,697	58,127
4.0 Feeder Buses	0	14,080	12,320	12,760	12,320	12,760	12,320	14,080	12,320	12,980	12,760	12,320
5.0 Concord Yard South Lead	0	0	0	0	0	0	0	10,000	10,000	10,000	10,000	10,000
6.0 Miscellaneous Structures	0	0	0	0	2,400	8,400	2,400	2,404	2,404	2,404	2,404	8,404

TABLE 2.3-1 (Continued)

Item	ALT 1	ALT 2	ALT 3	ALT 3A	ALT 4	ALT 4A	ALT 5	ALT 6	ALT 7	ALT 7A	ALT 7B	ALT 8
	Cost Estimate (000's)											
7.0 Transit Share of Willow Pass Grade	0	0	15,000	15,000	15,000	15,000	15,000	0	20,000	20,000	20,000	15,000
Total Cost	**0**	**14,224**	**171,994**	**122,494**	**388,825**	**318,448**	**386,180**	**152,910**	**553,560**	**284,028**	**391,247**	**394,384**
8.0 Right-of-Way	0	0	53,016	33,160	54,194	46,794	94,471	26,009	61,890	30,396	47,458	62,668
GRAND TOTAL	**0**	**14,224**	**225,010**	**155,654**	**443,019**	**365,242**	**480,651**	**178,919**	**615,450**	**314,424**	**438,705**	**457,052**

TABLE 2.4-1

SUMMARY OF ANNUAL OPERATING AND MAINTENANCE COSTS

Alternative		LRT[a]	BART[b]	CCCTA[b]	ECCTA[b]	Express Bus[a]	Grand Total	Cost Increment[c]
1	No Build	(d)	$175.13	$11.78	$1.87	$3.11	$191.89	NA
2	TSM	(d)	175.13	14.45	3.52	1.81	194.91	$3.02
3	HOV to Antioch	(d)	175.13	14.50	2.70	3.65	195.98	4.09
3A	HOV to Pittsburg	(d)	175.13	14.45[e]	3.13[e]	2.84[e]	195.55	3.66
4	LRT to Antioch	$9.54	175.13	14.44	2.67	2.31	204.09	12.20
4A	LRT to West Antioch	8.29	175.13	14.45[e]	3.13[e]	2.08[e]	203.08	11.19
5	LRT to Antioch via SPTC	10.21	175.13	14.43	2.69	2.31	204.77	12.88
6	BART to North Concord/Martinez	(d)	178.47	14.37	3.43	1.36	197.50	5.61
7	BART to Antioch	(d)	188.47	14.45	2.67	2.31	207.90	16.01
7A	BART to W. Pittsburg	(d)	181.23	14.45[e]	3.21[e]	1.83[e]	200.72	8.83
7B	BART to Pittsburg	(d)	183.60	14.45[e]	3.03[e]	2.05[e]	203.13	11.24
8	BART to North Concord/Martinez; LRT to West Antioch	6.91	178.34	14.45[e]	2.67[e]	2.08[e]	204.45	12.56

a Marginal annual operating costs (millions of 1987 dollars).
b Total annual operating cost (millions of 1987 dollars).
c Cost Increment = Annual cost of alternative minus annual cost of No-Build.
d LRT not operated in this alternative.
e Annual O&M cost estimated based on operating statistics interpolated by Bechtel 5/16/88.

JBX/4580001E1x

2.5 CAPITAL AND OPERATING-AND-MAINTENANCE COST INDICES

Based on the capital and operating-and-maintenance costs contained in Sections 2.3 and 2.4, and projected transit ridership which is described in Section 4, Transportation Impacts, a cost per guideway rider has been calculated for each alternative, as shown in Table 2.5-1. The costs shown include only the express bus on HOV lanes, LRT service, or BART service for each alternative; local bus service costs have been deducted. The column furthest to the right in the table indicates the cost per rider for each trip taken on the HOV, LRT or BART alternative in the Pittsburg-Antioch Corridor. The costs range from a low of $4.92 for Alternative 3A (Busway/HOV to Pittsburg), to a high of $24.90 for Alternative 5 (LRT to Antioch via State Route 4 and SPTC).

2.6 FINANCIAL CONSIDERATIONS

The Metropolitan Transportation Commission adopted Resolution No. 1876, New Rail Transit Starts and Extensions, in March 1988. This resolution outlines a regional rail transit funding plan for passenger rail extensions in the Bay Area, including the Pittsburg-Antioch Corridor. This resolution identifies the following potential capital funds for the corridor:

Funding Source	$ Millions
BART	34
San Mateo Existing 1/2 ¢ Sales Tax	74
Existing Bridge Tolls	9
New Bridge Tolls	56
Contra Costa 1/2 ¢ Sales Tax	178
State Funds	74
TOTAL	425

Other potential funding sources include value capture opportunities which are discussed in Section 5.2. It is estimated that these sources, however, would contribute in the range of 1 percent or less of required capital costs.

TABLE 2.5-1

RIDER COSTS BY TRANSPORTATION ALTERNATIVE
(1987 DOLLARS)

Alter-native		Length of Project (Miles)	Number of Stations	Projected Guideway Weekday Transit Trips (Year 2000)	Estimated Guideway Capital Cost (Million $)	Estimated Annual O&M Cost (Million $)	Total Annualized Capital and O&M Cost Per Guideway Rider ($)
1	**No Build**	NA	NA	NA	NA	NA	NA
2	**TSM**	NA	NA	NA	NA	NA	NA
	Busway/HOV						
3	Concord to Antioch	16.4	4	13,150[a]	$215[b]	$3.7[b]	$7.01[b]
3A	Concord to Pittsburg	10.3	2	12,850[a]	$145[b]	$2.8[b]	$4.92[b]
	LRT via State Route 4						
4	Concord to Antioch	16.2	6	8,300	$431	$9.5	$23.15
4A	Concord to W. Antioch	12.6	5	8,075	$352	$8.3	$19.67
	LRT via SPTC						
5	Concord to Antioch	16.7	7	8,375	$469	$10.2	$24.90
6	**BART to N. Concord/ Martinez**	2.3	1	10,850	$165	$3.2	$6.64
	BART via State Route 4						
7	Concord to Antioch	16.2	5	13,450	$603	$13.3	$19.99
7A	Concord to W. Pittsburg	7.1	2	12,000	$301	$6.1	$11.03
7B	Concord to Pittsburg	10.1	3	13,175	$426	$8.5	$14.18
8	**BART to N. Concord/ Martinez, LRT to W. Antioch via State Route 4**	12.6	4	11,800	$445	$10.1	$16.90

a Includes bus an ! HOV riders

b Busway/HOV alternatives do not include automobile capital or operating costs.

JBX/4580001E1x

SECTION 3

AFFECTED ENVIRONMENT

3.1 LAND USE

Land use patterns in the region and in the Pittsburg-Antioch Corridor Study Area are discussed in the following sections. The study area encompasses portions of Contra Costa County and the cities of Concord, Martinez, Pittsburg, Antioch, and Brentwood, as shown in Exhibit 3.1-1. Current and future land use patterns within the county and each city are discussed. Existing and general plan land uses are generally described along the alignment alternatives: Port Chicago Highway, Concord Avenue, State Route 242, State Route 4, and the SPTC line. The general plan land uses are evaluated to determine land use impacts in the year 2000. More specific land use data are provided for the existing Concord BART station and alternative station sites.

3.1.1 REGIONAL LAND USE SETTING

During the late 1970s and early 1980s, the population in Contra Costa County grew dramatically in response to an increase in employment opportunities in the San Francisco Bay area. As the cost of office space increased in the City of San Francisco, companies began to relocate to the East Bay (Alameda County) and Contra Costa County. Central Contra Costa County, which includes the cities of Martinez and Concord as well as the Interstate 680 corridor south of these cities, has had a rapid increase in employment. The Association of Bay Area Governments (ABAG) expects that the northern Interstate 680 corridor will be one of the fastest growing employment centers in the region, with a projected 21,000 new job opportunities between 1985 and 1990. As new office and commercial space has been constructed, residential development has followed. During the 1990s, ABAG anticipates that both commercial and residential development will slow considerably in the northern Interstate 680 corridor because of a lack of developable land (Contra Costa County 1986).

As northern Contra Costa County continues to grow in employment, eastern Contra Costa County, which includes the cities of Pittsburg, Antioch, and Brentwood, has grown in residential development. During the next two decades, ABAG expects eastern Contra Costa County to be one of the fastest growing areas within the San Francisco Bay region.

3.1.2 CORRIDOR STUDY AREA

The study area includes municipal jurisdictions in the vicinity of the corridor which includes portions of Contra Costa County and the cities of Concord, Martinez, Pittsburg, Antioch, and Brentwood. A discussion of the county's and each city's land use patterns follows.

Contra Costa County

The Pittsburg-Antioch Corridor Study Area includes the unincorporated communities of Clyde, Shore Acres, West Pittsburg, and Oakley, and other unincorporated areas located between the City of Concord and the community of Shore Acres, between the cities of Pittsburg and Antioch, and between the City of Antioch and the community of Oakley.

The community of Clyde is a compact residential area located north of the City of Concord and is within Concord's sphere of influence. The dominant land uses planned by the City of Concord for the area surrounding Clyde include employment-industry, parks-open space, and the U.S. Naval Weapons Station (City of Concord 1982). Contra Costa County has designated a majority of this area for heavy industrial uses (Contra Costa County 1986).

The communities of Shore Acres and West Pittsburg are located within the City of Pittsburg's sphere of influence. The dominant existing and planned land use for these areas is residential (City of Pittsburg 1980).

The community of Oakley is located partially within the City of Antioch's sphere of influence and partially in the City of Brentwood's sphere of influence. Oakley is currently a rural agricultural community that is evolving into a suburban community. Contra Costa County has designated the majority of the community area for residential uses (Contra Costa County 1986).

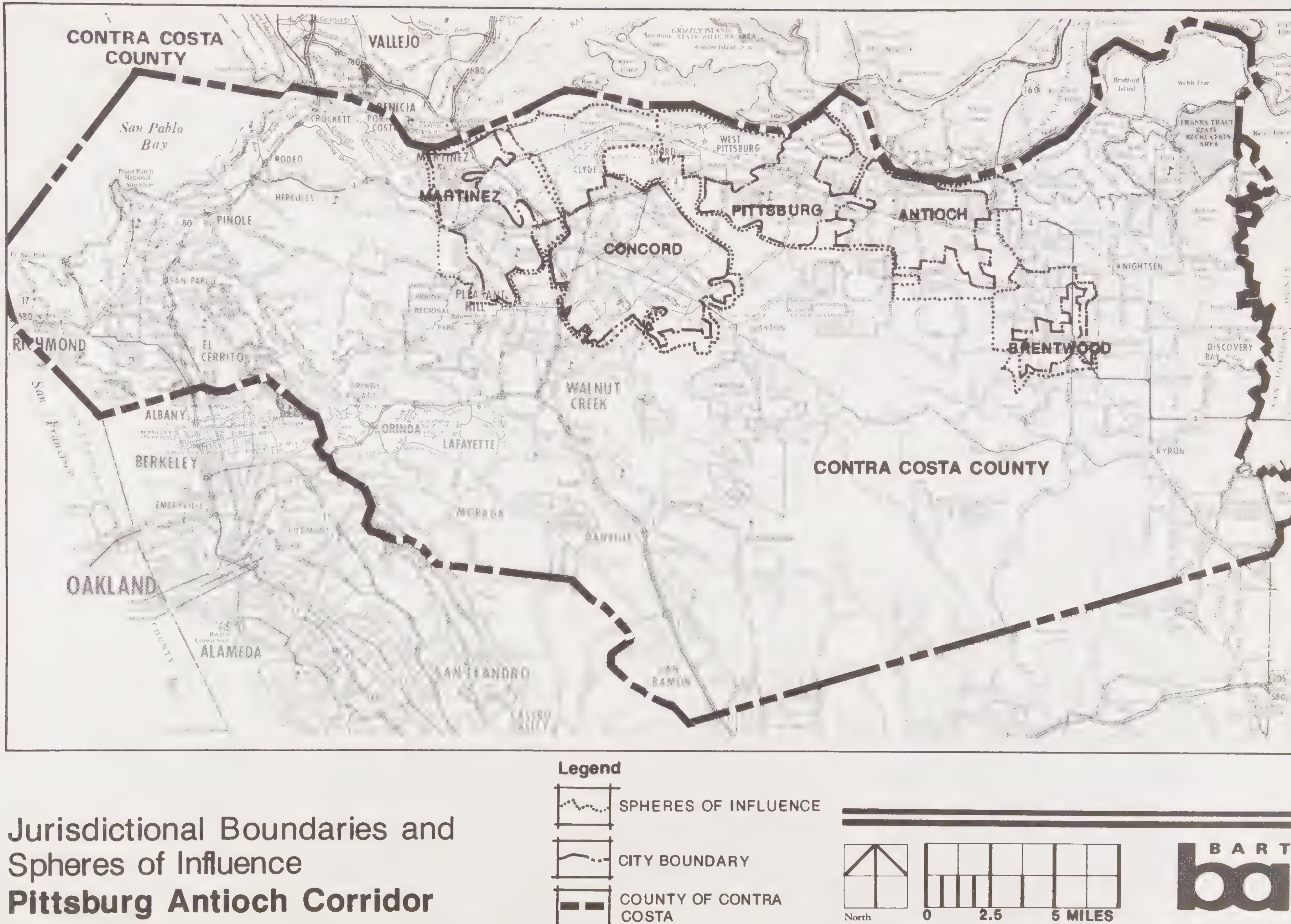
Other unincorporated areas within the study area currently have little development. The unincorporated area between the City of Concord and the community of Shore Acres is not included within any city's sphere of influence. Two other areas (between the cities of Pittsburg and Antioch and between the City of Antioch and the community of Oakley) are included within the spheres of influence and therefore anticipated to be eventually incorporated into one of the two cities.

City of Concord

The City of Concord is currently the largest city in Contra Costa County. The city's 1987 population was estimated to be 108,000 and the predominant land use is residential (ABAG 1987). The second largest land use is military, with the U.S. Naval Weapons Station, Concord. Over the next 20 years, ABAG anticipates that the City of Concord will have the largest increase in employment of any city in the county while the city's population is expected to increase to 114,900 (ABAG 1987). The majority of the employment growth is expected in the downtown business area and West Concord business/employment area (City of Concord 1982). In addition, a large unincorporated area north of State Route 4 and within the city's sphere of influence is planned for industrial development.

City of Martinez

The City of Martinez had a 1987 population estimated to be 36,100 (ABAG 1987). The predominant land use within the city is low density residential. The year 2005 population is projected to be 42,200 (ABAG 1987). Many of the city's general plan elements have not been updated since the mid-1970s; however, the city has concentrated on preparing "specific plan areas" for developments. Four designated



Jurisdictional Boundaries and Spheres of Influence

Pittsburg Antioch Corridor AA/DEIR

Exhibit 3.1-1

specific plan areas include: (1) the John Muir Parkway Specific Plan located in the east-central portion of the city, (2) the Alhambra Hills Specific Plan located in the southern portion of the city, (3) the Hidden Lakes Specific Plan located in the southeastern portion of the city, and (4) the Central Martinez Specific Plan located in the north-central portion of the city (Wallace, pers. comm., 1988). The John Muir Parkway Specific Plan could provide a maximum of 2,800 single family and multiple family homes and 2.5 million square feet of commercial and industrial uses. The Hidden Lakes Specific Plan is primarily built-out with residential uses while the Alhambra Hills Specific Plan could provide approximately 750 residential units. The Central Martinez Specific Plan provides mixed-use opportunities in the central business district (D. Wallace 1988; Contra Costa County 1986). Housing and commercial/office uses are designated for this specific plan area. In addition, oil industry uses are located in the northern portion of this specific plan area, adjacent to Carquinez Straits (City of Martinez 1973).

City of Pittsburg

The City of Pittsburg and the unincorporated areas of West Pittsburg and Shore Acres had a 1987 population estimated to be 50,400 (ABAG 1987). The predominant land use is residential and the majority of the dwelling units within the city and unincorporated area are low density (City of Pittsburg 1980). The unincorporated area of West Pittsburg is in the City of Pittsburg's sphere of influence. By 2005, ABAG projects the population of the City of Pittsburg, including West Pittsburg, would total 64,300 (ABAG 1987). The city has also designated large amounts of land for industrial uses that have not been developed. These uses are located mostly in the northwestern portion of the city (City of Pittsburg 1980).

City of Antioch

The City of Antioch had a 1987 population estimated to be 50,400 and the predominant land use is residential (ABAG 1987). Policies in the general plan are directed toward retaining the city's image and character as a desirable low-density river/foothill-oriented residential community. The city's population is expected to increase to approximately 88,600 by the year 2005 (ABAG 1987). Two specific plans were adopted in the early 1980s that have amended the general plan and the projected buildout population. The Southeast Antioch Specific Plan area is divided into six district neighborhoods each consisting of 400 to 1,200 acres (up to 3,500 dwelling units) and includes neighborhood services such as elementary schools, parks, and playgrounds. There are more than 8,000 dwelling units that have been approved or are planned for the southeast portion of the City of Antioch (Contra Costa County 1986).

The East Antioch Specific Plan has also significantly amended the general plan. The East Antioch area consists of 570 acres. The primary elements of the plan include over 200 acres designated for industrial development, approximately 200 acres planned for low and moderate density housing, and 26 acres planned for commercial development (Contra Costa County 1986).

City of Brentwood

The City of Brentwood had a 1987 population estimated to be 7,300 and the predominant land use is agriculture (ABAG 1987). The City of Brentwood General Plan indicates that future development in the city should move "toward a balanced community, rather than a bedroom community." Future residential growth is planned to the north and west of the downtown area with higher housing densities allowed around the central retail district to support downtown activities. Other planned employment areas are located in the southwestern portion of the city along State Route 4 and in the southeastern portion of the city along the SPTC line (City of Brentwood 1983). The City of Brentwood is expected to increase its population to 27,200 by 2005 (ABAG 1987).

3.1.3 EXISTING LAND USES ALONG THE CORRIDOR

Existing uses along the Pittsburg-Antioch Corridor range from vacant land to commercial and industrial developments, as shown in Exhibit 3.1-2. Following is a description of the uses along the alternative alignments (Concord Avenue/State Route 242, State Route 4 and SPTC) by city and county.

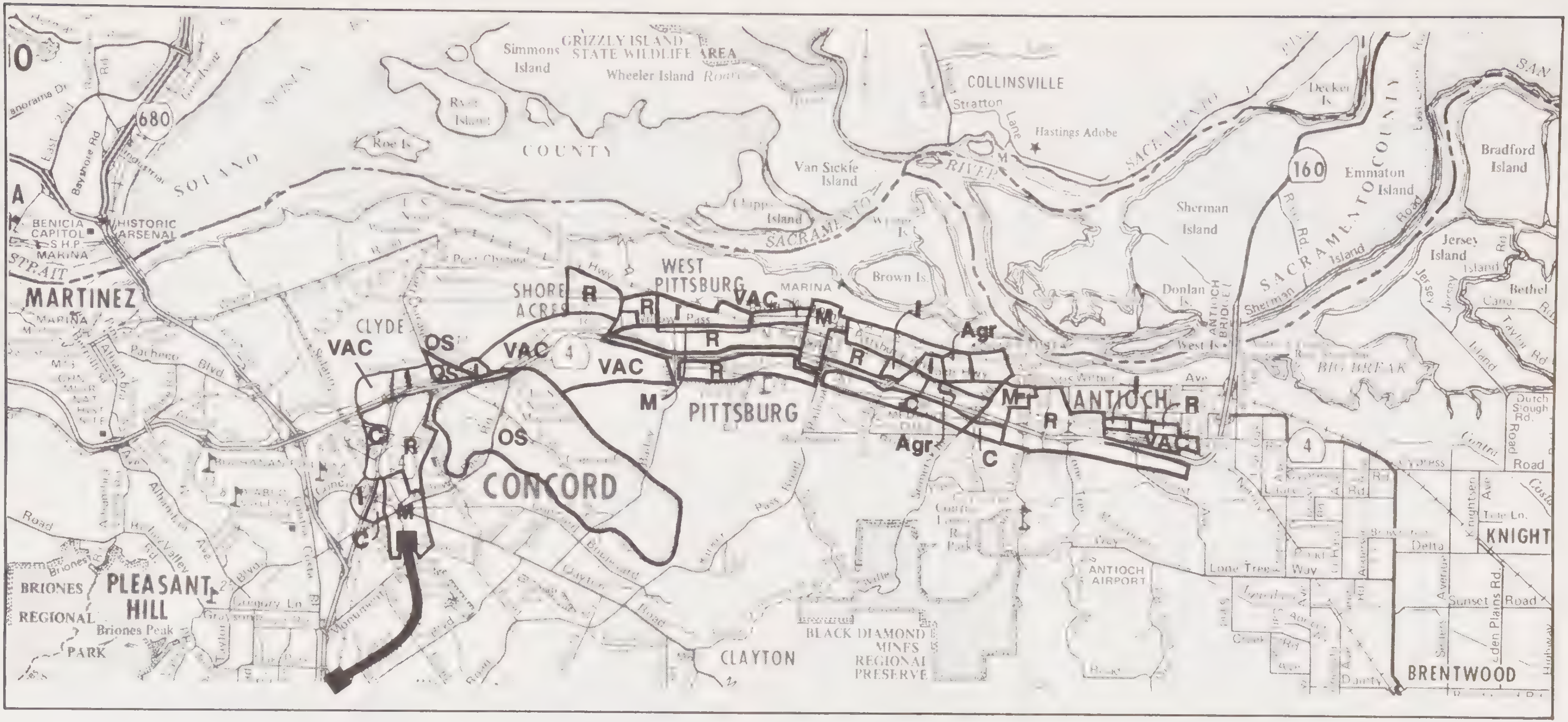
City of Concord

Alternatives 3 and 3A (HOV to Antioch, HOV to Pittsburg)

These alternatives extend from the existing Concord BART Station along Concord Avenue to State Route 242 and easterly on State Route 4. Land uses along Concord Avenue include a mix of commercial, office, and residential uses. Land uses along State Route 242 from Concord Avenue to East Olivera Road include a school, industrial uses, and low-density residential uses. Commercial uses occur along East Olivera Road. Uses north of East Olivera Road include high-density residential west of State Route 242 and low-density residential east of State Route 242. Land uses between State Route 242 and Port Chicago Highway include industrial north of State Route 4 and low-density residential south of State Route 4.

Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 (State Route 4 and SPTC Line Alignments)

Within the City of Concord, Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 are aligned along the same route. The route extends from the existing BART station in the City of Concord, along Port Chicago Highway to State Route 4, and easterly on State Route 4. Existing land uses along Port Chicago Highway include a mix of commercial, office, and residential in the downtown area while lower-density residential uses exist from Mount Diablo Hospital to State Route 4. Other existing uses along Port Chicago Highway include the John F. Baldwin Neighborhood Park located east of Port Chicago Highway and south of Erie Drive. Mount Diablo Hospital is west of the Port Chicago Highway and south of High School Avenue. Southeast of Port Chicago Highway/State Route 4 intersection is the U.S. Naval Weapons Station, Concord, which is undeveloped near the corridor. Also, a BART park-and-ride lot is on the U.S. Naval Weapons Station property and is located approximately 0.5 mile south of State Route 4 and just east of Port Chicago Highway. Some industrial uses occur on the U.S. Naval Weapons Station south of State Route 4 and west of Willow Pass Road. Northeast of the Port Chicago Highway/State Route 4 intersection are



LEGEND

R - RESIDENTIAL
C - COMMERCIAL & OFFICE
I - INDUSTRIAL
OS - OPEN SPACE
M - MIX (COMMERCIAL, RESIDENTIAL AND OPEN SPACE)
VAC - VACANT
Agr - AGRICULTURE

Existing Land Use

Pittsburg–Antioch Corridor AA/DEIR

North 0 1.5 3 MILES

BART

Exhibit 3.1-2

the Diablo Creek Golf Course and the U.S. Naval Weapons Station. The U.S. Naval Weapons Station, north of State Route 4, also contains industrial uses.

Alternatives 7, 7A, and 7B (South Yard Lead)

The south yard lead track for Alternative 7, 7A, and 7B is located within the existing BART maintenance facility and yard south of the Concord BART station. The lead track is approximately 900 feet in length. The land use of the area immediately surrounding the lead consists entirely of existing BART facilities. The main line tracks are located to the west and south, storage yard tracks abut the alignment of the lead to the east, and the maintenance facility is north of alignment. Residential uses surround the BART yard, but are setback at least 200 to 300 feet from the alignment of the south yard lead.

<u>Contra Costa County (West Pittsburg)</u>

Alternatives 3, 3A, 4, 4A, 7, 7A, 7B, and 8 (State Route 4 Alignments)

Alternatives 3, 3A, 4, 4A, 7, 7A, 7B, and 8 extend along State Route 4 from the City of Concord to the City of Pittsburg through unincorporated areas. The eastern portion of the unincorporated area includes the community of West Pittsburg. Over the Willow Pass Grade from the City of Concord to West Pittsburg, the majority of the land is vacant with only a few residences and commercial uses. In the West Pittsburg area, vacant land continues south of State Route 4 to approximately Bailey Road. The majority of the land in the West Pittsburg area, east of Bailey Road, contains single-family residences.

Alternative 5 (LRT to Antioch via SPTC)

Alternative 5 extends from the City of Concord along State Route 4 to Willow Pass Road in West Pittsburg. From this intersection, the alignment extends northeast to the SPTC line. Land uses along the alignment from State Route 4 to the SPTC line include single-family and multiple-family residences, commercial uses, and industrial uses. Land uses along the SPTC alignment through West Pittsburg include industrial and vacant land.

<u>City of Pittsburg</u>

Alternatives 3, 3A, 4, 4A, 7, 7A, 7B, and 8 (State Route 4 Alignments)

Land uses along these alignments in the City of Pittsburg include a mix of single-family and multiple-family residences, commercial, office, industrial, and vacant lands. Other uses include a BART park-and-ride facility, the Civic Center, the senior citizen's center, Del Monte Center, and Los Medanos College. The BART park-and-ride facility is located southwest of the State Route 4 and Bailey Road intersection. The Civic Center is located northwest of the Railroad Avenue and State Route 4 intersection. The Civic Center includes city, county, and school district offices, and a California National Guard Armory building. In addition, north of the Civic Center is the Pittsburg City Park which includes the Neighborhood Historical Center Museum. The senior citizen's center and the Del Monte Center are located south of State Route 4 along Crestview Drive. Los Medanos College is located south of State Route 4 in the eastern portion of the City of Pittsburg.

Alternatives 4A and 8 (State Route 4 Alignments)

The LRT maintenance yard site is located in the City of Pittsburg at the northeast corner of State Route 4 and Loveridge Road. The existing land use is agricultural with a general plan designation of industrial.

Alternative 5 (LRT to Antioch via SPTC)

Land uses along the SPTC alignment in the City of Pittsburg include residential, office, industrial, agriculture, and vacant lands. Other uses include the Santa Fe Railroad, the Pittsburg City Park, and the SPTC Depot. The Santa Fe Railroad is located north of and adjacent to the SPTC line. Just east of Willow Pass Road the Santa Fe Railroad extends farther north of the SPTC line. The Pittsburg City Park is located south of the SPTC line at Railroad Avenue and the SPTC Depot is located north of the SPTC line at Railroad Avenue. At Harbor Street, the alignment parallels the SPTC line to approximately California Avenue.

City of Antioch

Alternatives 3, 4, 4A, 7, and 8 (State Route 4 Alignments)

Land uses along these alignments in the City of Antioch include residential, commercial, office, industrial, agriculture, and some vacant land. Other uses along the alignments include the Contra Loma Park and the BART park-and-ride facility. Contra Loma Park is located north of State Route 4 and west of Contra Loma Boulevard. The BART park-and-ride facility is located north of State Route 4 at Hillcrest Avenue.

Alternative 5 (LRT to Antioch via SPTC)

Land uses along this alignment in the City of Antioch include residential, commercial, office, industrial, agriculture, and vacant lands. Other uses include the Contra Costa County Fairgrounds and the BART park-and-ride facility along Hillcrest Avenue which was discussed previously. The Contra Costa County Fairgrounds is located south of the SPTC line and west of Railroad Avenue.

3.1.4 STATION LOCATIONS

In addition to the general discussion of the uses along the alignments, a more specific description of the existing and general plan uses onsite and adjacent to the existing BART station in the City of Concord and the alternative station sites within the corridor is provided in this section (see Appendix A, in Volume 2 of this report, for exhibits of existing and general plan land use designations for each station). The description of adjacent uses include the uses within approximately 0.25 mile of the alternative station sites. Table 3.1-1 provides a summary of the existing and general plan uses onsite and adjacent to the existing Concord BART Station and alternative station sites.

TABLE 3.1-1

EXISTING AND GENERAL PLAN ONSITE
AND SURROUNDING USES AT ALTERNATIVE STATION SITES

	STATIONS											
	A	B	C	D	E	F	F(ALT)	G	H	I	J	K
Existing Onsite Uses												
Residential												
Commercial								X			X	
Industrial						X	X				X	
Public Facility						X		X				
Park												
Vacant				X	X	X	X	X				
Agriculture									X	X		X
Parking	X		X	X								X
Onsite General Plan Designations												
Residential												
Commercial	X			X				X			X	
Industrial					X		X		X	X	X	X
Public Facility				X		X						
Park												
U.S. Naval Station			X									
Parking												
Existing Surrounding Uses												
Residential	X	X	X	X	X	X	X	X	X	X	X	X
Commercial	X	X			X	X	X	X	X	X	X	
Industrial					X		X		X	X	X	X
Public Facililty		X			X	X		X	X	X		
Park		X				X						
U.S. Naval Station			X									
Vacant	X			X				X	X	X	X	X
Agriculture									X	X		
Surrounding General Plan Designations												
Residential	X	X	X	X	X	X	X	X	X	X	X	X
Commercial	X	X		X	X	X	X	X	X	X	X	X
Industrial					X		X		X	X	X	X
Public Facility		X				X		X				
Park						X						
U.S. Naval Station			X									
Vacant												
Agriculture												
Parking												

Source: Michael Brandman Associates 1988.

The alternative station locations in the corridor include three in the City of Concord, one in the community of West Pittsburg, five in the City of Pittsburg, and three in the City of Antioch (see Exhibit 3.1-3).

Station A (Concord)—Alternatives 4, 4A, and 5

The Concord LRT Station alternative is planned adjacent to the existing BART station and would use its parking facilities. The Concord BART Station is located on the northwestern corner of the Clayton Road and Oakland Avenue intersection. It includes parking on the northwest and southeast portions of the station which is consistent with the commercial use designation in the City of Concord General Plan. The uses associated with the existing station are also consistent with the Central Concord Redevelopment Plan. A joint development project is proposed on existing BART property and would include office space, a hotel, a theater, and parking garages to replace existing parking that would be removed. Existing land uses immediately surrounding the station include residences to the southeast, a neighborhood shopping center to the northeast across Clayton Road, and high-rise office buildings (Bank of America, Concord Center, and Tishman Concord Center) north of the station. General Plan land uses surrounding the site include commercial, office, and residential.

Station B (Mount Diablo Hospital)—Alternatives 4, 4A, and 5

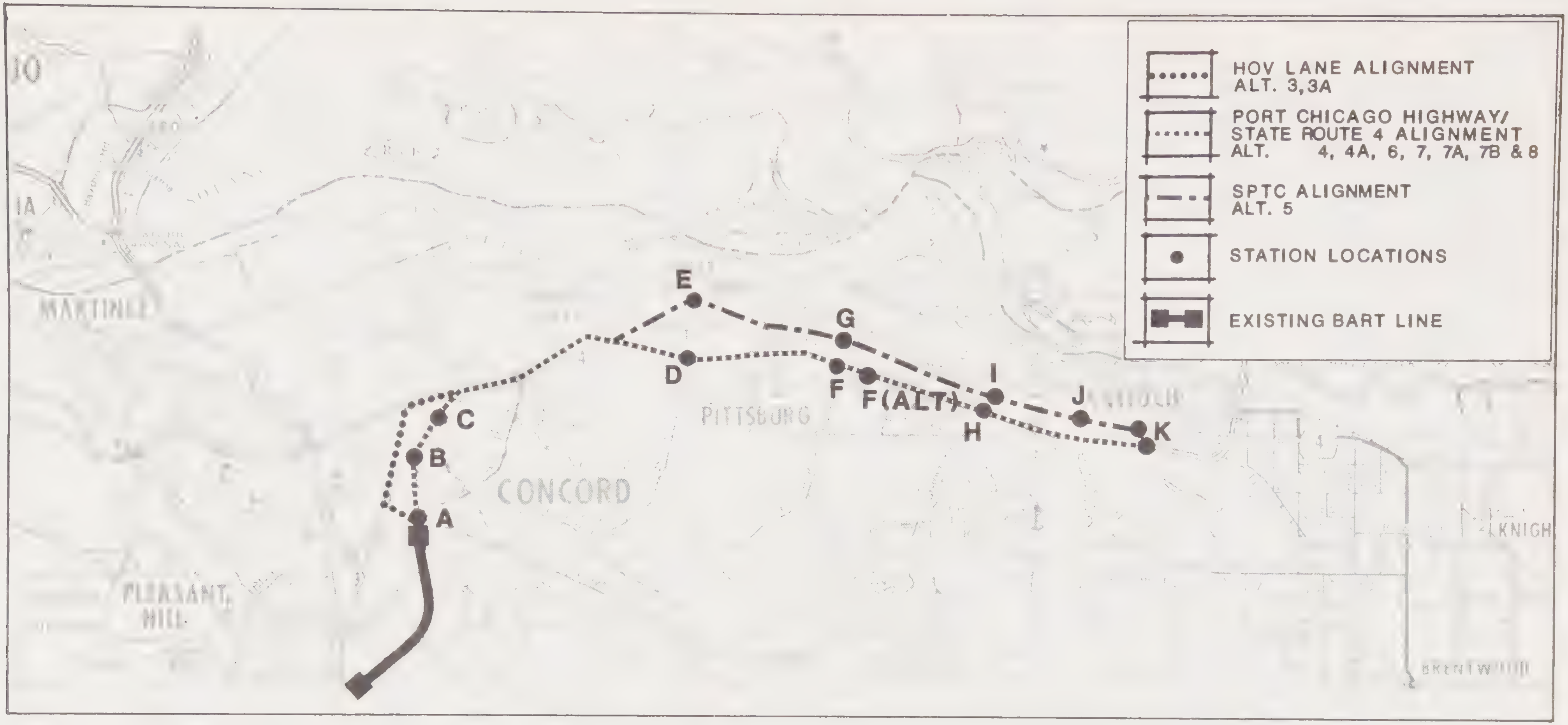
The Mount Diablo Hospital LRT Station alternative is planned along Port Chicago Highway, south of High School Avenue. This station would not provide parking facilities; however, bus transferring facilities would be provided along Port Chicago Highway. Land uses in the vicinity include medical offices, parking, and multiple family residential to the south; residences and John F. Baldwin Park to the east; and medical offices and residences to the north. West of the hospital and across East Street are Williams Elementary School and Mount Diablo High School. These surrounding uses are consistent with the land uses designated in the Concord General Plan.

Station C (North Concord/Martinez)—Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8

The North Concord/Martinez Station alternative for BART or LRT modes would be located at the existing BART park-and-ride facility which is approximately 0.5 mile south of State Route 4 and just east of Port Chicago Highway. Currently, the park-and-ride facility is on land designated for the U.S. Naval Weapons Station in the Concord General Plan. Existing land uses in the area include the U.S. Naval Weapons Station to the north and east and residences to the west and south. The area designated as military immediately surrounding the site is vacant. The surrounding general plan designations are consistent with the existing uses.

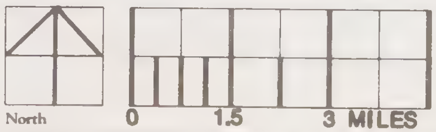
Station D (Bailey Road in West Pittsburg at State Route 4)—Alternatives 3, 3A, 4, 4A, 7, 7A, 7B, and 8

Station D for either the LRT or BART modes is planned for the area southwest of the existing State Route 4 and Bailey Road intersection. The station site currently contains a BART park-and-ride facility and vacant land. The general plan land use for the station site is public facility. Existing land uses currently surrounding the station site include residences to the south and east, with State Route 4 and



Note: Letters Correspond to Table 3.1-1.

Locations of Station and
Park-and-Ride Alternatives
Pittsburg-Antioch Corridor
AA/DEIR



BART

Exhibit 3.1-3

commercial and residential uses north of the site. West of the site is a large vacant, undeveloped area. General plan land uses include residential to the west and south and commercial and residential to the east and north of State Route 4.

Station E (West Pittsburg on SPTC Alignment)—Alternative 5

The West Pittsburg LRT Station alternative is planned between Willow Pass Road and the SPTC line west of the Shell Chemical industrial plant. Currently, this area is vacant and designated for industrial uses in the West Pittsburg Community Plan. Existing land uses surrounding the proposed station include residential, office, and commercial to the south across Willow Pass Road, residences to the west, and the Shell Chemical industrial plant and grazing activities to the east. North of the station site is vacant land. General plan land uses surrounding the site include residential to the west, commercial and residential to the south, and industrial to the east and north.

Station F (Railroad Avenue in the City of Pittsburg at State Route 4)—Alternatives 3, 3A, 4, 4A, 7, 7B, and 8

The Pittsburg Station for the State Route 4 alignment alternatives would be located northwest of the State Route 4 and Railroad Avenue intersection and southeast of Davi Avenue and Civic Avenue. Existing onsite uses include city, county, and school district offices; the California National Guard Armory building; and vacant land. The general plan designation for the station site is public facility, which is consistent with the existing uses. Existing uses adjacent to the station site include residential to the west, a city park to the north, and commercial and residential uses to the east. South of the station site are residential and commercial uses. General plan land uses surrounding the station site are primarily consistent with the existing uses.

Station F (ALT) (Harbor Street in the City of Pittsburg at State Route 4)—Alternatives 3, 3A, 4, 4A, 7, 7B, and 8

Station F (ALT) is an alternative location to the Station F site north of State Route 4. This station is planned southwest of the State Route 4 and Harbor Street intersection. Existing onsite uses include an industrial park with some vacant areas. The station site is currently designated for industrial uses in the City of Pittsburg General Plan. Surrounding uses include commercial storage to the south and southeast, industry to the east, residences to the north, and commercial and offices to the west, which is primarily consistent with the land uses designated in the Pittsburg General Plan.

Station G (City of Pittsburg at SPTC Alignment)—Alternative 5

Station G is along the SPTC portion of Alternative 5 and east of Railroad Avenue. Existing onsite land uses include commercial and vacant areas. Commercial uses are currently designated for the station site. Surrounding uses include residences south of Depot Street, Central Junior High School on the southwest corner of Harbor Street and Depot Street, and commercial uses southwest of Central Avenue and Solar Street and east of Railroad Avenue. West of Railroad Avenue are commercial and residential uses. Surrounding general plan land uses are primarily consistent with the existing uses.

Station H (Somersville Road in Pittsburg at State Route 4)—Alternatives 3, 4, 4A, 7, and 8

The West Antioch Station for State Route 4 alignment alternatives is planned west of and adjacent to the Contra Costa Canal between Standard Oil Avenue and Somersville Road. While the LRT or BART platform is located in the City of Antioch, the parking facilities for the station are located in the City of Pittsburg. (See Appendix A for an illustration of the city boundaries.) The site where the parking facilities for this alternative are proposed is designated for industrial uses in the City of Pittsburg General Plan and currently supports agricultural activities. The transit platform is planned in the median of State Route 4. Existing land uses surrounding the parking facilities site include additional agricultural land that is designated for industrial and commercial uses. There are also industrial uses north of the Southern Pacific Transportation Company railroad line and residential, commercial, and vacant uses and Los Medanos Junior College south of State Route 4. These uses south of State Route 4 are located in the City of Antioch.

Station I (West Antioch at SPTC Alignment)—Alternative 5

The Alternative 5 West Antioch LRT Station is planned west of the Contra Costa Canal, south of the SPTC, and east of Standard Oil Avenue. This station would primarily serve the West Antioch area; however, the station is located in the City of Pittsburg. (See Appendix A for an illustration of the city boundaries). The site is designated for industrial uses in the City of Pittsburg General Plan and currently contains agricultural activities. Uses surrounding the station include agricultural land that is designated for industrial and commercial uses. Other uses include vacant land and industrial.

Station J (City of Antioch at SPTC Alignment)—Alternative 5

The Antioch LRT Station for Alternative 5 is planned north of the SPTC, west of A Street, east of D Street, and south of Railroad Avenue. The station site is currently designated for industrial and commercial uses in the City of Antioch General Plan. Existing uses on the site are consistent with the general plan designations. Uses adjacent to the station include vacant, commercial, and residential.

Station K (Hillcrest Avenue in East Antioch at State Route 4)—Alternatives 3, 4, 5, and 7

The East Antioch Station for the State Route 4 alignment alternatives is planned northeast of the State Route 4 and Hillcrest Avenue intersection. Currently, this area contains a BART park-and-ride facility and agricultural uses and is designated for industrial uses. Surrounding uses include residential and vacant land to the south, vacant land to the east, an electrical substation and vacant land to the north, and residential and industrial uses to the west.

3.2 ECONOMIC ACTIVITY/DEMOGRAPHICS

3.2.1 REGIONAL TRENDS

Contra Costa County is presently one of the fastest growing counties in the San Francisco Bay Area. Over the past 30 years, a combination of growth in office and service-related employment has transformed the county into a major regional employment center. Contra Costa County is projected to continue this high growth over the next few decades. It is then anticipated that the rate of growth will slow as the supply of land considered appropriate for development diminishes.

Population

Contra Costa County's population increased by 17.5 percent between 1970 and 1980, and by 1987 the population was estimated to have increased by another 11.9 percent for a total of 734,450 (Table 3.2-1). Household growth exceeded population growth during this period.

Although median and mean nominal family income more than doubled between 1970 and 1980, in constant dollars there was little change during the decade. Average household income for 1980 in Contra Costa County ($29,885) was slightly higher than in the San Francisco Bay Area as a whole ($28,185).

Most households have access to automobiles. In 1980, only 6.5 percent of households were without a vehicle and almost 60 percent of households had two or more vehicles. This high degree of auto accessibility is typical of middle income, suburban communities.

Employment Trends

The San Francisco Bay Area economy has undergone major structural changes in the last decade, which have affected Contra Costa County. The Bay Area has experienced a growth in service and finance, insurance, and real estate sector employment over this period. There has also been a simultaneous decline in basic manufacturing employment (such as the steel industry) accompanied by growth in high technology and information-based manufacturing industries. All these trends can be seen in Contra Costa County as well. Since 1980, 22 plant closures have resulted in the loss of 2,400 jobs in the manufacturing sector. This occurred while employment grew in the trade, finance, insurance, real estate, and services sectors by a total of 32,500 jobs. (See Appendix B for more detailed information.)

From 1975 to 1985, total employment grew from 155,500 to 247,400 jobs or an increase of approximately 60 percent in Contra Costa County, but this rate of growth has been declining. The annual growth rate from 1975 to 1980 was approximately 6.5 percent, declining to 4 percent annually in the following 5-year period (see Appendix B).

TABLE 3.2-1

POPULATION CHARACTERISTICS
CONTRA COSTA COUNTY STUDY AREA, CITIES, AND UNINCORPORATED AREAS

	Contra Costa County				City of Antioch				Brentwood Area (Census Tracts 3031 & 3032)			
	1970	1980	% Change 1970-1980[a]	1987 Estimate	1970	1980	% Change 1970-1980[a]	1987 Estimate	1970	1980	% Change 1970-1980[a]	1987 Estimate
Total Population	558,389	656,380	17.5	734,450[b]	28,060	42,683	52.1	51,789[b]	5,632	8,134	44.4	NA
Number of Households	173,951	241,534	39.7		8,593	14,955	74.0		1,661	2,637	58.8	
Income of all Families												
Mean	$13,778	$29,885	1.6		$11,679	$23,902	-4.2		$10,344	$25,096	13.6	
Median	$12,423	$26,510	-0.1		$10,972	$22,904	-2.2		NA	NA		

	Clyde Area (Census Tract 3150p)				City of Concord				City of Martinez			
	1970	1980	% Change 1970-1980[a]	1987 Estimate	1970	1980	% Change 1970-1980[a]	1987 Estimate	1970	1980	% Change 1970-1980[a]	1987 Estimate
Total Population	529	404	-23.6	NA	85,164	103,255	21.2	108,009[b]	16,506	22,582	36.8	28,783[b]
Number of Households	179	160	-16.5		24,574	38,152	55.3		5,309	8,406	58.3	
Income of all Families												
Mean	$11,593	$20,685	-16.5		$12,690	$26,844	-0.1		$12,484	$28,793	8.0	
Median	$11,071	$21,250	-10.1		$12,614	$25,648	-4.8		$12,014	$27,310	6.4	

	Oakley Area (Census Tract 3020)				City of Pittsburg				West Pittsburg Area[c]			
	1970	1980	% Change 1970-1980[a]	1987 Estimate	1970	1980	% Change 1970-1980[a]	1987 Estimate	1970	1980	% Change 1970-1980[a]	1987 Estimate
Total Population	4,670	7,098	52.0	NA	20,651	33,034	60.0	41,623[b]	10,007	10,295	2.9	NA
Number of Households	1,411	2,508	77.7		6,445	11,087	72.0		3,213	3,996	24.4	
Income of all Families												
Mean	$9,210	$23,247	18.2		$9,633	$22,416	9.0		$8,682	$16,350	-11.9	
Median	$8,922	$21,153	11.0		$9,224	$21,684	10.1		NA	NA	NA	

a Although dollar amounts presented in this table are unadjusted, for purposes of calculating a percentage change between 1970 and 1980, dollar amounts have been adjusted to the base year of 1967 using the CPI for all items (San Francisco-Oakland SMSA: 1970 = 1.158 and 1980 = 2.473).
b 1987 California State Department of Finance estimates.
c West Pittsburg Area comprised of Census Tracts 3141 and 3142. Tract 3090P is included in 1980 to compensate for a Census Bureau error. Part of Tract 3141 was annexed to Pittsburg in the 1980 Census and is not included in that year's West Pittsburg totals.

Source: With the exception of a few characteristics noted above, the source for the table is U.S. Department of Commerce, Bureau of the Census 1970, 1980.

Real Estate Trends

Although Contra Costa County's housing stock rapidly expanded in the 1970s, it was not until the first half of the 1980s that the county experienced phenomenal increases in office development. Between 1980 and 1985 an additional 10 million square feet of office space was absorbed, for an annual absorption rate of over 2 million square feet (Coldwell Banker 1986). At the end of 1985, an additional 9 million square feet of office space was under construction. Rent levels ranged between $1.25 and $2.50 per square foot per month for newly constructed buildings. Some of this newly constructed space is located in business parks (Bishop Ranch Business Park in San Ramon with 5 million square feet), and some is located in large, single-tenant buildings, such as Bank of America's 1-million-square-foot office complex in the City of Concord.

Real estate development trends in Contra Costa County indicate predominantly residential growth in east county cities and commercial development in central county cities (see Appendix B). The corridor along Interstate 680 has been the primary location for new office construction. This corridor spans both Alameda and Contra Costa counties. In Contra Costa County, the cities of Walnut Creek and San Ramon have received the most growth. The eastern portion of Contra Costa County, the primary location for the transportation alternatives, has not shared in central county's office development. Instead, it continues to be a residential area, and workers commute from there to other employment centers (Contra Costa County, Community Development Department [CDD] 1985).

At present, the suburban office market in Contra Costa County is experiencing high vacancy rates. This is similar to trends throughout the country (Grubb & Ellis 1987). However, construction of new space continues, in spite of high vacancies, rent concessions, and rent reductions needed to attract tenants to occupy vacant space. In part, this may be due to concerns over future growth controls on office construction. In the City of Walnut Creek, such controls have already been adopted affecting construction in the downtown area.

Aside from office development, the county has recently experienced growth in industrial development such as warehouses, retail distribution centers, and laboratories. This new development is also located along the Interstate 680 corridor. Much of this development primarily houses economic activities that either support the office developments or are spin-offs from it. Tenants occupy small spaces, housed in attractive, low-rise buildings (Grubb & Ellis 1987). There is strong demand for retail space located in quality properties, and vacancy rates are relatively low (Northern California Real Estate Journal 1987). However, recent appraisal information indicates approximately a 10 year supply of light industrial sites. This is based on the current slow absorption rate of properties now on the market.

Finally, the county has been an active area for new residential construction, although the level of subdivision activity has varied greatly from year to year. The detached, single-family house is still the most popular type of new construction, but there has been a shift toward more multifamily housing. (See Appendix B for more detailed information.)

3.2.2 STUDY AREA TRENDS

Economic Trends

Many countywide economic trends are also found in some study area cities, including the decline of basic manufacturing industries and the growth of financial, insurance, and real estate, service, and trade employment. Recent shutdowns at the Pittsburg USX Corporation (formerly U.S. Steel) facilities resulted in the loss of over 800 jobs since 1975. However, there remains a sizable manufacturing industrial base which includes paper products, chemicals, and steel production. The cities of Pittsburg and Antioch have experienced net job growth in spite of the economic structural shifts that have taken place, mostly due to employment growth in the low-wage service and trade sectors (U.S. Department of Commerce, Bureau of the Census 1977, 1982).

One of the biggest boosts to the study area's economy was the massive relocation of Bank of America employees to the City of Concord, which was completed by the end of 1987. This move has not only brought several thousand new finance industry jobs to the city but promises to spur job growth in supportive services and commercial enterprises.

Socioeconomic Projections

Table 3.2-2 presents ABAG growth projections for Contra Costa County and study area cities for 1980 to the year 2000. Contra Costa County's employment and population growth are projected to increase at a faster rate (74.9 percent and 33.7 percent, respectively) than that of the nine-county San Francisco Bay Area (46.7 percent and 24.7 percent, respectively). However, average household income in the county will increase at a slightly slower rate than average Bay Area income (21.2 percent compared to 26.8 percent).

Within the study area, the cities of Brentwood and Antioch are projected to experience the fastest population growth rate. All cities are projected to have average incomes that are slightly lower than the county's average income. The income levels are projected to be about the same in all the study area cities except Pittsburg, where average income will be substantially lower than in the other four study area cities.

Employment growth is projected to be higher in all study area cities than it is projected to be in the nine-county San Francisco Bay Area. The highest growth rates, again, are for Brentwood and Antioch. In actual numbers, Concord will add the most jobs--over 30,000 between 1980 and the year 2000. In the cities of Martinez and Concord, there is a balance between the number of employed residents and the amount of employment within the city. Although it is not possible to conclude that employed residents will be working at local jobs, this possibility is more likely in the cities of Concord and Martinez than in the cities of Brentwood, Antioch, and Pittsburg, where there is a greater disparity in projections between the number of employed residents and the level of local employment. This implies that residents of these three cities are more likely to be commuting to other cities than residents in Concord and Martinez.

TABLE 3.2-2

GROWTH PROJECTIONS, 1980-2000

CONTRA COSTA COUNTY

	1980	1985	1990	1995	2000	% Change 1980-2000
Population	656,380	705,000	777,000	829,200	877,900	33.7
Households	241,534	263,370	298,420	327,160	354,720	46.9
Household Size	2.69	2.64	2.57	2.50	2.44	-9.3
Employment[a]	202,166	236,900	287,500	326,400	353,500	74.9
Employed Residents	307,476	350,100	402,400	446,600	477,100	55.2
Mean Household Income in Constant 1985 Dollars	$39,040	$42,500	$44,100	$45,800	$47,300	21.2

CITY OF ANTIOCH

	1980	1985	1990	1995	2000	% Change 1980-2000
Population	45,961	50,900	59,000	70,400	82,900	80.4
Households	16,142	18,010	21,750	27,080	33,160	105.4
Houshold Size	2.83	2.80	2.69	2.58	2.49	-12.0
Employment[a]	8,732	10,300	12,300	16,200	18,200	108.4
Employed Residents	20,056	23,400	29,400	38,200	45,300	125.9
Mean Household Income in Constant 1985 Dollars	$32,376	$35,400	$38,800	$41,900	$44,500	37.4

TABLE 3.2-2 (Continued)

CITY OF BRENTWOOD

	1980	1985	1990	1995	2000	% Change 1980-2000
Population	6,785	7,300	8,800	12,700	21,700	219.8
Households	2,233	2,440	3,060	4,670	8,340	273.5
Household Size	3.00	2.97	2.82	2.70	2.59	-13.7
Employment[a]	1,083	1,400	1,800	2,100	2,500	130.8
Employed Residents	2,577	3,000	3,700	6,000	11,000	326.9
Mean Household Income in Constant 1985 Dollars	$31,649	$35,100	$36,500	$38,100	$41,000	29.5

CITY OF CONCORD

	1980	1985	1990	1995	2000	% Change 1980-2000
Population	104,800	107,400	111,300	113,800	114,800	9.5
Households	38,322	40,430	43,350	45,350	46,710	21.9
Household Size	2.70	2.63	2.54	2.48	2.43	-10.0
Employment[a]	33,912	43,600	54,900	59,600	64,900	91.4
Employed Residents	53,403	58,300	62,600	66,800	67,700	26.8
Mean Household Income in Constant 1985 Dollars	$35,606	$38,800	$39,200	$41,200	$42,900	20.5

TABLE 3.2-2 (Continued)

CITY OF MARTINEZ

	1980	1985	1990	1995	2000	% Change 1980-2000
Population	30,822	36,100	39,400	41,400	42,100	36.6
Households	11,405	13,630	15,300	16,400	17,090	49.8
Household Size	2.65	2.59	2.50	2.45	2.38	-10.2
Employment[a]	11,348	13,600	15,900	17,700	18,500	63.0
Employed Residents	15,123	18,800	21,500	23,300	24,100	59.4
Mean Household Income in Constant 1985 Dollars	$36,695	$40,500	$40,700	$42,800	$43,600	18.8

CITY OF PITTSBURG

	1980	1985	1990	1995	2000	% Change 1980-2000
Population	43,843	50,400	58,600	61,700	63,600	45.1
Households	15,207	17,530	21,190	22,990	24,440	60.7
Household Size	2.87	2.86	2.75	2.66	2.58	-10.1
Employment[a]	10,702	11,500	13,600	16,500	17,800	66.3
Employed Residents	17,205	20,800	25,900	28,300	30,200	75.5
Mean Household Income in Constant 1985 Dollars	$27,651	$30,700	$32,400	$32,900	$33,600	21.5

a The employment indicator represents the total number of jobs in the area, some of which are held by local residents and others held by workers outside the area.

1985-2000 estimates are for April 1 of each year. 1980 numbers are actual values.

Source: ABAG 1987.

Public Finance Trends

Recent audits by the Office of the State Controller indicate all five cities can be considered fiscally sound, but there are other indicators of fiscal strength which should be considered besides a city's ability to balance the budget. Per capita retail sales and net assessed property valuation are two of such indicators. The cities of Martinez and Pittsburg had low per capita retail sales levels that were just over half the county figure in 1982. Concord's per capita retail sales were well above the county average indicating a relative strength in generating sales tax revenues. Per capita net assessed property value for all five cities was below the county average in fiscal year 1984-1985 (State of California, Office of the Controller 1984-1985). This puts the study area cities at a slight disadvantage in their ability to generate revenue through property taxes.

Local Real Estate Trends

The following section briefly summarizes local real estate trends in many of the study area cities and unincorporated areas. (General sources include Grubb & Ellis 1987; Northern California Real Estate Journal, June 8-June 21, 1987; Coldwell Banker, Summer 1987.) (For more detailed discussion, see Appendix B.)

City of Martinez

During the 1980s the City of Martinez has experienced some of the new office development which is occurring along Interstate 680; however, the city accounts for only 3 percent of the approximately 20 million square feet of office space in the Interstate 680 corridor, compared with the City of Concord, which contains 15 percent.

City of Concord

The City of Concord has experienced significant growth in office and industrial development. As of February 1988, industry experts estimated that 1 million square feet of office space was vacant, so that the vacancy rate neared 30 percent (out of a total of approximately 3.5 million square feet). However, given the building moratorium in Walnut Creek and stabilized rents in Concord, it is possible that absorption will not be a problem (Northern California Real Estate Journal 1988). The cost of existing space was between $1.12 and $2.00 per square foot per month.

Although a majority of office space has been occupied by tenants engaged in wholesale, retail, and manufacturing operations, new space constructed since 1984 has been successfully marketed to firms in the more traditional "office-type" operations, such as banks and data processing. Some of the office space is now occupied by large single tenants, such as Chevron and the Bank of America. Quality industrial space is also being developed in the City of Concord; in 1986, over 200,000 square feet of industrial space was under construction.

In an effort to spur downtown development, the city created a redevelopment district in downtown Concord. So far, redevelopment has been successful in attracting new office, residential, and commercial construction. The area is still undergoing redevelopment. There are several new office projects immediately adjacent to the Concord BART Station. One Concord Centre is the highest building in the county, at 15 stories. Gateway I and Gateway II are twin office buildings. Although Gateway II is nearing completion and is still vacant, Gateway I is fully leased. Finally, the Bay Area Rapid Transit District plans a multi-use, joint development project on District-owned land at the Concord BART station. The proposed project would contain 500,000 square feet of office space in two towers, a 300- to 400-room hotel, and a theater. Since this project would be constructed on land that is currently used as surface parking, two 900-space BART patron parking garages would also be built. (The hotel and office projects would each provide their own parking onsite). The hotel will be developed first, and the District will lease the land to a hotel operator/developer on a long-term lease (Mundie & Associates 1988; O'Banion 1988).

West Pittsburg

New development has primarily been residential. At the end of 1986, over 2,000 housing units were either under construction, approved for construction, or pending approval. Contra Costa County has recently established a new redevelopment project area in West Pittsburg, covering the majority of this unincorporated area.

City of Pittsburg

The City of Pittsburg has for several years worked to revitalize its downtown area. The chief funding mechanism for redevelopment is the Los Medanos Project Area Redevelopment Plan adopted in 1979. This redevelopment area covers approximately 70 percent of the city. The intent is to use property tax increments from the new residential construction south of State Route 4 to revitalize the downtown area and fund infrastructure improvements in developing areas (Contra Costa County 1986).

Much of the HOV, LRT, and BART alignment along State Route 4 in the City of Pittsburg runs through this redevelopment area--specifically, the segment beginning approximately 1 to 2 miles west of Railroad Avenue and ending just west of Somersville Road. The same is true of the SPTC LRT alignment, although the segments passing through the redevelopment area are somewhat different since the SPTC alignment is farther north. Specifically, the Southern Pacific alignment enters the redevelopment area east of Jimno Avenue (just west of the Railroad Avenue Station), and continues through the City of Pittsburg until just west of Loveridge Road. Then, between Standard Oil Avenue and Somersville Road, the SPTC tracks form the northern boundary of the redevelopment area.

Another redevelopment project is to encourage reuse of industrial facilities that are no longer operating at capacity. These facilities are primarily owned by USX (formerly known as U.S. Steel) Corporation and by Dow Chemical USA. USX Corporation, in conjunction with a South Korean steel corporation (known as U.S. Posco), is modernizing its plant and attracting additional tenants who would use the output of the steel plant (<u>Northern California Real Estate Journal</u>, June 8-June 21, 1987).

In March 1988, the City of Pittsburg's request for a portion of the city to be declared an Enterprise Zone succeeded. Some of the Enterprise Zone policies relevant to real estate development include capital improvements to city infrastructure, and city fee waivers and reductions for new construction and rehabilitation (Borunda 1988).

More of the BART and LRT alignment along State Route 4 in the City of Pittsburg runs through this Enterprise Zone than does the LRT alignment along the SPTC tracks. Beginning at Lido Way and continuing until east of Railroad Avenue, the State Route 4 alignment is in the Enterprise Zone. The State Route 4 alignment re-enters the zone at approximately Diane Avenue and exits at Standard Oil Avenue. One segment of the LRT alignment along the SPTC tracks that is located in the Enterprise Zone is a segment that runs along either side of the SPTC Depot. A second segment enters just east of Standard Oil Avenue and continues in the Enterprise Zone until Somersville Road. (This second segment is the northern boundary of the Enterprise Zone.)

In addition to revitalizing downtown and redeveloping industrial areas, the City of Pittsburg is currently redeveloping its marina area. The marina project includes demolishing older housing units and constructing 400 new townhouses and a 200-boat facility at the marina. Additional new development is underway at a vacant area known as the Baker property, which will eventually contain over 1 million square feet of improvements including a major shopping center of at least 700,000 square feet (Larry Seeman Associates 1986). A Target store has already been completed at this site.

Residential construction is projected to continue at a fast rate. Over 3,000 additional units are planned, the majority of which are multiple housing units. Additionally, a large development of 3,000 units is slated for an area that was formerly a Chevron tank storage area (at Somersville and Buchanan). About half of these units will be located in the City of Pittsburg and about half in the City of Antioch (City of Pittsburg 1987).

City of Antioch

The city currently has over 1 million square feet of retail and commercial space. Approximately half of this space is accounted for by two adjacent shopping centers in West Antioch (County East Mall and Delta Fair). Several additional shopping centers are either under construction or are already completed. Recent commercial projects near the West Antioch BART/LRT alternative station site include Delta Square Business Park (50,000 square feet) and Orchard Square (100,000 square feet). A smaller retail center, Sunset Plaza, has been approved at a site immediately to the north of the Antioch BART Station alternative (City of Antioch 1988a).

The City of Antioch created a redevelopment project in 1986 that encompasses the East Antioch BART/LRT Station. The goal of the redevelopment project is to improve area access, storm drainage, sewer and water problems, mixed land use, and fragmented parcelization. Additionally, it intends to upgrade existing development and encourage new development. The redevelopment area consists of four subareas, one of which is the alternative LRT/BART station, and the remainder of which will either be developed in residential or industrial uses (City of Antioch 1986a).

Finally, residential construction in Antioch is projected to be very active. At least 15,000 more housing units are planned. Southeast Antioch is the most active area for new construction, located at a distance from any of the proposed BART or LRT stations (Contra Costa County CDD 1988). There is a Southeast Specific Plan covering this part of Antioch. This planning area is located immediately south of the LRT/BART State Route 4 alignment, beginning at Lone Tree Way and continuing until the terminus at the East Antioch Station (City of Antioch 1982).

3.3 NEIGHBORHOODS

There are several established neighborhoods along the Pittsburg-Antioch Corridor. These neighborhoods include uses that range from residential to industrial. The term "neighborhoods" as defined by the Urban Mass Transportation Administration is used for this analysis and the definition is as follows:

> A residential settlement and/or business/industrial district which is identifiable together based on its physical and topographic boundaries, uniform building types, strong focal point of business, recreational or institutional nature, historical name or identity or a combination of these characteristics.

3.3.1 CITY OF CONCORD NEIGHBORHOODS

In the City of Concord, the transportation alternative routes include Alternative 3 and 3A (Concord Avenue/State Route 242 alignments), and Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 (Port Chicago Highway alignments). The area from the existing BART station to State Route 242 via Concord Avenue primarily includes commercial and offices uses with some residential uses. This area is located in the central business district neighborhood which is characterized as a strong focal point of business. Residential neighborhoods are primarily located along State Route 242 from Concord Avenue to State Route 4. These neighborhoods, located west of State Route 242, are distinctly separated from the neighborhoods east of State Route 242. Furthermore, the industrial neighborhoods north of State Route 4 between State Route 242 and Port Chicago Highway are distinctly separated from the residential neighborhoods south of State Route 4.

The area along the Port Chicago Highway alignment from the existing Concord BART station to Port Chicago Highway contains commercial and office uses. These uses are located in the central business district neighborhood. Several residential neighborhoods are located along Port Chicago Highway from Salvio Street to State Route 4. Because of the 100-foot-plus width of Port Chicago Highway, the neighborhoods west of the roadway are physically separated from the neighborhoods east of the roadway.

3.3.2 WEST PITTSBURG NEIGHBORHOODS

Two transportation routes are proposed in the community of West Pittsburg. Alternative 5 is from State Route 4 to the SPTC line and Alternatives 3, 3A, 4, 4A, 7, 7A, 7B, and 8 follow State Route 4. West Pittsburg is primarily an older residential community that is considered to be one cohesive neighborhood. West Pittsburg contains primarily single-family homes, varying in density, with some mobile home units. A new development was recently constructed in West Pittsburg northeast of the Port Chicago Highway and Willow Pass Road intersection. Because of the uniform building type and the recreational amenities available to the development, this area is considered a separate neighborhood from the remaining portions of the community (Raycraft 1988).

3.3.3 CITY OF PITTSBURG NEIGHBORHOODS

The two proposed alignment alternatives in the City of Pittsburg are the SPTC line and State Route 4. Residential, commercial, and recreational neighborhoods are adjacent to the SPTC line. Only one residential neighborhood, located east of Harbor Street, is on the north and south sides of the SPTC line. This residential neighborhood contains primarily single-family homes of approximately the same age and of uniform building types.

Currently, the State Route 4 transportation route in the City of Pittsburg separates the neighborhoods north of State Route 4 from the neighborhoods south of State Route 4. Neighborhoods adjacent to State Route 4 in the City of Pittsburg include primarily residential, with some commercial and public facility uses.

3.3.4 CITY OF ANTIOCH NEIGHBORHOODS

The SPTC line and State Route 4 alignments also cross the City of Antioch. The City of Antioch General Plan has identified 13 neighborhood areas based on predominant physical separation, statistical district comparison, and integrated or homogenous characteristics. The freeway currently separates the neighborhoods adjacent to the State Route 4 alignments. The SPTC line crosses through four of Antioch's established neighborhoods: West Antioch, Fairview, Mid-Central, and Mountain View. Currently, the West Antioch neighborhood is primarily vacant and under agriculture and is designated for industrial uses by the City of Antioch. The Fairview neighborhood contains primarily residential with some neighborhood commercial. The Mid-Central neighborhood contains a mix of residential, commercial, and industrial uses. The Mountain View neighborhood is primarily residential.

3.4 TRANSPORTATION

3.4.1 EXISTING TRANSPORTATION FACILITIES AND SERVICES

Existing Freeways

State Route 4 (see Exhibit 3.4-1) is a six-lane restricted access highway between Port Chicago Highway and Willow Pass Road (west) and a four-lane restricted access highway between Willow Pass Road (west) and the Antioch Bridge in Antioch. A major constraint to the operation of this roadway is the Willow Pass Grade on State Route 4 which is located approximately 2 miles east of Port Chicago Highway. This facility is projected by the Metropolitan Transportation Commission to operate at Level of Service (LOS) F in the year 2000 between Somersville Road in Antioch and Willow Pass Road (west) in Concord. LOS F is described as operations with delays unacceptable to most drivers, occurring due to oversaturation, poor progression, or very long cycle lengths. LOS E is projected between Willow Pass Road (west) and Port Chicago Highway. LOS E is considered the limit of acceptable delay, with poor progression, long cycle lengths, and high volume-to-capacity ratios.

State Route 242 is a four-lane restricted access highway between State Route 4 and Interstate 680. This facility is projected by MTC to operate at LOS E-F in the year 2000.

Interstate 680 is a six-lane restricted access highway between State Route 242 and State Route 4. This facility is projected by MTC to operate at LOS E-F in the year 2000.

Existing Major Roadway Links

Port Chicago Highway is a two-lane arterial highway between State Route 4 and Salvio Street in Concord. An LOS of D is forecast by MTC in the year 2000. At LOS D, long delays are due to a combination of unfavorable progression, long cycle lengths, or high volume-to-capacity ratios. The U.S. Navy is proposing to close this highway where it passes through the U.S. Naval Weapons Station; however, the traffic would remain in the corridor. Willow Pass Road is a two-lane arterial highway between State Route 4 and Concord. LOS F is forecast by MTC in the year 2000. Bailey Road is a two-lane arterial highway between State Route 4 and Concord. An LOS of D is forecast by MTC in the year 2000. Kirker Pass Road is a two-lane arterial highway between State Route 4 and Concord. LOS C is forecast by MTC in the year 2000. A LOS of C is considered operations with average delays.

Existing Transit Service

Three BART-operated park-and-ride facilities are located within the corridor. They are located in North Concord/Martinez along the Port Chicago Highway, in West Pittsburg at State Route 4 and Bailey Road, and in Antioch at State Route 4 and Hillcrest Avenue. The Bay Area Rapid Transit District contracts with Laidlaw Transit Inc. for the provision of express bus service from the Concord BART Station to Martinez, and from the Concord Station to the Antioch-Brentwood area. Although the express buses are intended for BART patrons, the routes have become heavily utilized by non-BART riders, who use the local service, especially in the east county area. The District plans to streamline the express bus operations by routing more

buses onto freeways and off local streets, and eventually turn over local service to the local transit districts.

The East Contra Costa Transit Authority (also known as Tri-Delta Transit) contracts with Laidlaw to operate four fixed-route lines in the east county and a dial-a-ride service. In the 5-year Short Range Transit Plan for Tri-Delta Transit, the agency plans for bus service to remain at the same level. Dial-a-ride service would remain constant at nine buses. Saturday Dial-a-ride is also planned for fiscal year 1988-89.

3.4.2 GROWTH PROJECTIONS AND TRANSPORTATION PROBLEMS IN THE CORRIDOR

As the corridor population has grown, State Route 4, which links eastern Contra Costa County with employment centers, has become increasingly congested. During peak travel periods, State Route 4 between Willow Pass Road (west) in Concord and Willow Pass Road (east) in West Pittsburg is at LOS F, exceeding the design capacity of the roadway. The MTC projects that the number of commuters out of eastern Contra Costa County via the State Route 4 corridor will increase substantially from 23,600 in 1980 to 63,900 in the year 2000, or by 171 percent.

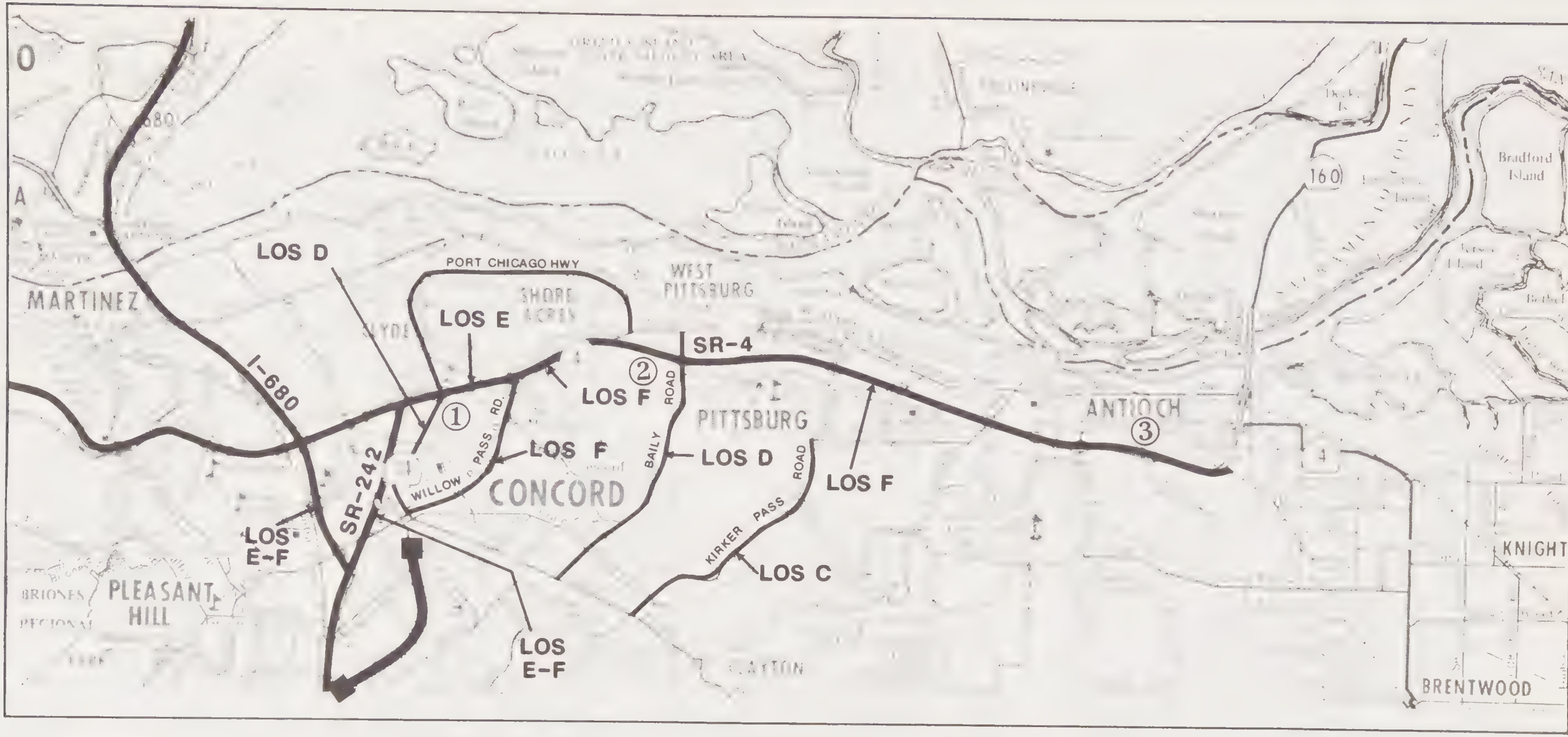
Future transportation demands in this corridor cannot be satisfied by highway improvements alone. Both highway and transit improvements are needed. Even if State Route 4 was widened from four to eight lanes, MTC estimates an LOS of F by the year 2000. Furthermore, there is no present funding to expand State Route 4.

In addition, the BART terminus in downtown Concord is not easily accessible to corridor area residents. Typically Martinez, North Concord, and east Contra Costa County park-and-ride patrons must travel either approximately 1 mile from State Route 242 or 2.5 miles from State Route 4 via congested, local streets to reach the downtown BART Concord Station. This congestion represents a major deterrent for residents of these areas to use BART. Expanding transit to the east would provide a more direct freeway access for corridor area residents and establish a much more efficient transit link between eastern Contra Costa County and the employment centers of central Contra Costa, Alameda, and San Francisco counties.

Access constraints at the existing BART Concord Station terminus are severe. During a typical weekday, the 1,910-space BART Concord Station parking lot fills by 7:00 a.m. and all available nonrestricted on-street parking within one-half mile of the station is fully utilized. In addition, the Pittsburg-Antioch "P" Route BART express bus operates at 90 percent capacity during peak periods. An extension of transit to Antioch would alleviate Martinez, North Concord, and eastern Contra Costa County access demands at the BART Concord Station, thereby freeing parking and bus capacity for BART Concord residents in the Concord Station vicinity.

3.5 VISUAL QUALITY AND AESTHETICS

The affected visual environment consists of a number of relatively distinct areas of landscape character. These include the area from the existing Concord BART station to Salvio Street, Concord Avenue and State Route 242 to State Route 4, Port Chicago Highway from Salvio Street to State Route 4, State Route 4 from Port



Legend

- FREEWAYS
- MAJOR ROADWAYS LINKS
- ① PARK-AND-RIDE FACILITIES
  1. NORTH CONCORD/MARTINEZ
  2. BAILY ROAD
  3. HILLCREST AVENUE
- EXISTING BART LINE
- EXISTING BART CONCORD STATION
- D — MTC PROJECTED LEVEL OF SERVICE FOR YEAR 2000

Existing Transportation Facilities/Level of Service

Pittsburg–Antioch Corridor AA/DEIR

North 0 1.5 3 MILES

BART

Exhibit 3.4-1

Chicago Highway to Bailey Road, State Route 4 from Bailey Road to Loveridge Road, State Route 4 from Loveridge Road to Hillcrest Avenue, and the area along the existing railroad right-of-way from West Pittsburg to Hillcrest Avenue.

3.5.1 AREA 1—CONCORD BART STATION (BART STATION TO SALVIO STREET)

The area along the western portion of Oakland Avenue to Clayton Road is strongly residential in character, dominated by small, one-story dwellings. Dense residential development, flat topography, and trees and vegetation in the area limit most views to only 1 block or less. Slightly farther east along Oak Street, new office high-rise structures are visible from many points, including Interstate 680. This distinctly "new" area makes a transition into an older commercial setting along Clayton Road and East Street. Continuing north across Willow Pass Road, the small-scale commercial nature of the area gives way to older residential development. Views are limited in all directions by mature tree and shrub growth.

3.5.2 AREA 2—CONCORD AVENUE/STATE ROUTE 242 TO STATE ROUTE 4

Concord Avenue is a heavily travelled roadway. During most portions of the day, relatively high volumes of traffic are present. The section between Salvio Street and State Route 242 is presently being widened (the Concord Avenue Improvement Project by the City of Concord). The visual character along Concord Avenue is primarily created by one-story commercial development. Commercial buildings vary in age, but generally present a contemporary appearance and feature well maintained landscaped grounds. The widening of Concord Avenue will likely foster a feeling of openness when travelling along this segment. Mature vegetation is evident at numerous locations.

State Route 242 between Concord Avenue and State Route 4 features two lanes of traffic in each direction. East- and west-bound traffic is currently separated by a median strip. The median is planted with large, flowering shrubs (oleander), commonly seen along highways in the Bay Area. Shrub plantings are dense between Concord Avenue and Olivera Road. East of the Olivera Road overpass, median plantings become somewhat sparse and change to grass cover at the intersection of State Route 4. Residential development lies on either side of State Route 242 up to the State Route 4 intersection. Between Concord Avenue and Olivera Road, the pavement of State Route 242 is slightly elevated so that the road surface is approximately level with rooftops of adjacent residences. Development is generally set back at least 150 feet from the shoulder of the highway and in many places, berms exist between the highway and the adjacent neighborhoods. Mature vegetation also helps limit views from residences of highway traffic.

3.5.3 AREA 3—PORT CHICAGO HIGHWAY (SALVIO STREET TO STATE ROUTE 4 INTERCHANGE)

Overall, this segment is characterized by residential structures, generally one story high, on both sides of Port Chicago Highway. Views to State Route 4 from the adjacent residential development are limited by tree cover. John F. Baldwin Park is generally enclosed by mature vegetation, particularly on the west side, which also

limits views of traffic on Port Chicago Highway. Mount Diablo Hospital is partially screened, but has views across Port Chicago Highway to the east. The area south of High School Avenue is relatively flat and contains a good deal of mature vegetation, limiting long-range views to about 0.5 mile.

North of North 6th Street, undeveloped hills are visible in the distance. Residences are located on both sides of the highway; their backyards, which are relatively small and contain mature trees, border on the bike path and road. This type of setting continues northward (aside from a small shopping center at the northwest corner of Olivera) to just south of Panoramic Drive near the existing BART park-and-ride facility. Here the roadway begins to rise and Mount Diablo becomes visible in the distance. Residences west of the highway (Sunview and Bayview Courts, etc.) have panoramic views, particularly to the east and south-southeast.

Near the State Route 4/Port Chicago Highway interchange, views open into wide, unobstructed vistas heavily influenced by the surrounding hills with glimpses of the Delta to the north-northwest. Landform, rather than built features, dominates views.

3.5.4 AREA 4—STATE ROUTE 4 (PORT CHICAGO INTERCHANGE TO BAILEY ROAD EXIT)

When travelling along State Route 4 from Port Chicago Highway eastward to the Bailey Road interchange, views become generally unobstructed and feature wide panoramas, including a scene of Mount Diablo several miles to the south-southeast. From the State Route 242 and Port Chicago Highway interchanges, eastbound travellers on State Route 4 are presented with an impressive, head-on view of Willow Pass. The massive, rolling ridge over which Willow Pass Grade rises is a dominant visual feature of this area and is directly in front of viewers, controlling long-range views to the east. As motorists approach Willow Pass Grade summit, the roadbed rises several hundred feet above the valleys below. Large, rolling, grass-covered hills and sweeping valleys dominate, with tank farms and high-rise office buildings visible in the distance. Development in this area is subordinate to the natural, large-scale landforms and the skyline which is formed by the wooded ridgeline of the hills.

Along State Route 4 at Willow Pass Grade summit, views to the north and south are restricted by close-lying hills which rise directly from the roadway shoulder. While high-voltage electrical transmission lines pass over the highway, views are dominated by the landscape and the Sacramento-San Joaquin Delta to the east. Farther east, new residential development is visible just north of the highway, with the City of Pittsburg located directly east. Views across the highway to the south are of smooth, rolling grass-covered hills, but views of transmission lines paralleling the roadside and industrial development in the City of Pittsburg become stronger as motorists approach Bailey Road.

3.5.5 AREA 5—STATE ROUTE 4 (BAILEY ROAD EXIT TO LOVERIDGE ROAD EXIT)

New residential development dominates the viewshed to the north, while older residential development views are to the south of State Route 4. At the Pittsburg city line, views are dominated by a multitude of transmission-line support structures protruding into the skyline, overshadowing intense residential development to the north and south. These views continue farther east, past Harbor Street. The visibility of segments of State Route 4 is limited by segments of mature vegetation.

3.5.6 AREA 6—STATE ROUTE 4 (LOVERIDGE ROAD EXIT TO HILLCREST AVENUE EXIT)

Views in Area 6 are dominated by a number of industrial plants, with hills visible in the distance. To the south of State Route 4, commercial development becomes more prevalent (auto dealers, hotels, etc.) surrounded by residential areas. Undeveloped grassy hills form most of the skyline when looking south; however, these views are subordinate to development and existing transmission lines. Segments of State Route 4 are below grade in this area.

Near G Street, views north of State Route 4 revert to intensive residential character; views south are of less dense residential development. At Hillcrest Avenue, new residential development characterizes views to the south, while a large electrical substation, partially screened by trees, is located to the north.

3.5.7 AREA 7—EXISTING SPTC RIGHT-OF-WAY FROM WEST PITTSBURG TO HILLCREST AVENUE

Residential development near West Pittsburg is apparent to the north and south and increases in intensity near the junction of Willow Pass Road and Port Chicago Highway. Looking east along Willow Pass, new residential development is seen along the north side of the road (partially screened by a sound wall), while the south side is lined with older commercial and small business development. Hills are visible to the west, but are overshadowed by utility poles and the existing residential and commercial development along the roadside. East of Alves Lane, development becomes less dense; views to the north are across an open field to the hills and Sacramento River in the distance. Approaching Bailey Road, vegetation along the north side of Willow Pass screens views to the north.

East of Bailey Road along Willow Pass, development becomes less dense but is industrial in nature, particularly looking north. Hills form the skyline in the middleground to the south, while transmission lines are seen heading into the Pacific Gas and Electric Pittsburg power plant to the north. The character of the area remains generally industrial until the Pittsburg city limits, where residential development begins to dominate views. Approaching Loveridge Road from the west, the foreground to the north is increasingly dominated by industrial development and transmission lines. Undeveloped hills are partially visible to the south.

Views east of Loveridge Road are of industrial areas. The Delta is visible in the background to the north while partial views of distant hills form the skyline to the south. The Delta Business Park is visible just north of the railroad right-of-way west of Somersville Road. Views to the north continue to be dominated by open space and industrial development (USX plant, etc.), with intermittent glimpses of the Delta and Solano County hills beyond. To the south, bold, rolling, large-scale hills become more visible in the middleground, with Mount Diablo in the background. Extensive grading is visible just west of Somersville between the railroad right-of-way and State Route 4.

East of Somersville Road, the overall character of the area becomes much more residential. The existing railroad right-of-way runs directly through neighborhood areas as well as past occasional commercial areas and along the south side of the county fairgrounds. Farther east, views are dominated by residential and commercial development. East of A Street the railway continues to run within areas of intense neighborhood character featuring small homes and abundant mature tree growth. Nearing Hillcrest Avenue, residential density decreases somewhat, particularly just east of Hillcrest, where an electrical substation surrounded by trees is located north of State Route 4. Overall, however, homes and development dominate views to the north and south.

3.6 HISTORIC AND CULTURAL SITES

3.6.1 INTRODUCTION

In accordance with prevailing cultural resources management requirements and guidelines, historic and archaeological properties which may be affected by proposed transit projects must be evaluated in regard to significance, impacts, and mitigation. Because the proposed project is a major transit study, this section has been prepared following Federal Section 106 Guidelines for Transportation Alternatives Analysis; however, this project will be processed in accordance with the CEQA guidelines. Section 106 of the National Historic Preservation Act requires that federal agencies identify and assess the effects of expenditures of federal funds on historic sites, districts, and buildings, and on archaeological sites.

Under Section 106 requirements, a thorough analysis of all resources is required, including the determination of significance (as per National Register of Historic Places nomination criteria) of all historic and prehistoric resources. However, it is noted in "Procedures and Technical Methods for Transit Project Planning," prepared by the Urban Mass Transportation Administration, that for alternatives analysis studies, a complete cultural resources evaluation is probably not possible: "in effect, the purpose of the effort is to identify any likely problems in meeting the Section 106 requirements for each alternative.... This general guideline provides substantial latitude for determining the level of effort" to be accomplished for alternatives analysis studies.

UMTA guidelines limit this phase of the cultural resources work. Consequently, the alternatives analysis study tasks, while not complete, are believed to be well within the evaluation parameters as per the UMTA procedural guidelines. These tasks, which were developed in consultation with the State Historic Preservation Office (SHPO) in Sacramento, are as follows:

- Inventory the historic and archaeological properties located within the project area of potential environmental impact and conduct preliminary field surveys to assess the presence of previously unrecorded resources.

- Assess the potential impacts on resources that are listed on the National Register of Historic Places, as well as those properties that are potentially eligible for listing on the National Register.

- Discuss mitigation/management alternatives for minimizing the potential impacts on significant resources and recommend additional studies required to complete Section 106 requirements.

3.6.2 STUDY METHODS

The cultural resources studies for the Pittsburg-Antioch Corridor Alternatives Analysis were initiated by consulting with the SHPO for purposes of reviewing the study corridors and the criteria for determining the Area of Potential Effect (APE). Archival review was then undertaken by reviewing existing materials that relate to prehistoric and historic resources and resource potentials within the project study area.

The APE was delineated by reviewing the Project Plan and Profile Drawings and consulting with SHPO. It is assumed that the APE for Alternatives 1, 2, 3, and 3A will eventually be determined by the California Department of Transportation (Caltrans) and the Federal Highway Administration (FHWA); for this alternatives analysis it is assumed that the APE for these four alternatives will be confined to the existing State Route 242, State Route 4, and Concord Avenue right-of-ways. The APE for Alternative 4 (LRT to Antioch) and 4A (LRT to West Antioch) has a maximum width of 130 feet where the LRT corridor parallels Port Chicago Highway and where the LRT corridor is located in the State Route 4 median. The alignment from the Concord BART Station to State Route 4 parallels the east side of Port Chicago Highway with a maximum offset of 65 feet from the roadway median. The Alternative 5 (LRT to Antioch via SPTC) APE is the same as LRT Alternatives 4 and 4A up to the State Route 4-Willow Pass Road (east) intersection, where the LRT alignment proceeds north to the SPTC right-of-way. The LRT APE then has a maximum width of 125 feet, which generally corresponds to the SPTC right-of-way. The Alternative 6 (BART to North Concord/Martinez) APE has a maximum width of 120 feet along the Port Chicago Highway from the Concord BART Station to State Route 4. The BART alignment parallels the east side of the roadway with a maximum offset of 70 feet from the median. The APE for the BART Alternatives 7, 7A, 7B, and 8 is basically the same as for the LRT Alternatives 4 and 4A. The numerous station locations and parking areas vary in size; however, their boundaries are clearly delineated on the Plan and Profile Drawings and those boundaries are assumed to be the APE for those facilities.

3.6.3 CORRIDOR RESOURCES

Two known archaeological sites are within the vicinity of the study corridor:

- CA-CCo-19 is located approximately 1,600 feet southwest of the Concord BART station, between the Concord BART Station and State Route 242 (see Appendix C, Map 2). The site is reported to be of unknown age and areal extent. A portion of the site has reportedly been disturbed; however, it is possible that prehistoric cultural deposits, with good depositional integrity, are still present. Such deposits would likely yield information important to the study of Contra Costa County prehistory. The site is therefore considered to be a potentially significant archaeological site.

- CA-CCo-250 is located approximately 0.5 mile east of Port Chicago Highway (see Appendix C, Map 2). Despite the fact that the site has been greatly disturbed it is possible that additional cultural deposits are still present, particularly in the form of prehistoric and early historic period Native American burials. Deposits of this nature are of great cultural significance, particularly to the Native American community. Also, previous studies of the site resulted in a high yield of artifacts; if similarly abundant caches of artifacts are still present, such materials would be very valuable to local and regional archaeological studies. CA-CCo-250 is, therefore, regarded as a potentially significant cultural resource.

The distances of these two sites from the corridor indicate that they will be outside the APE. Their importance is in their proximity to the study corridor and the implied potential for similar subsurface sites in the area.

Nine historic properties in the Concord area are located relatively close to the project and three properties in the Pittsburg area are located in the corridor's APE. All are considered to be historically significant by local planning agencies and historical preservation groups. The present level of research for most of the buildings does not permit a complete evaluation of their eligibility for listing on the National Register of Historic Places. However, their status in the communities warrants future consideration of National Register eligibility.

The following listing summarizes the historic architectural resources near the corridor alignments.

<u>City of Concord</u>

- Salvio Pacheco Adobe, 1870 Adobe Street. Built by the founding family of Concord in the Mexican Colonial period, the significance of this building has been recognized by its designation as a State Historic Landmark (No. 515) and is likely to be eligible for listing on the National Register. The structure is located at least 150 feet southwest of the Concord Avenue.

- Concord Fire Hall, 982 Concord Avenue. This late Italianate-style firehouse of circa 1890 is a Concord Historic Landmark. While architecturally distinctive, the building would not be eligible for the National Register because it has been moved from its original site. The structure is located on the southwest side of Concord Avenue, approximately 25 feet from the APE.

- Perry House, 1990 Concord Avenue. A 1911 Prairie-style house recognized as a Concord Historic Landmark, but not eligible for the National Register because it has been moved from its original site. The structure is located on the southwest side of Concord Avenue, approximately 25 feet from the APE.

- Foskett and Elworthy Building, 2001 Salvio Street. A 1911-1912 Mission Revival-style commercial building recognized as a Concord Historic Landmark. The building has been refurbished, but would appear to have sufficient architectural integrity in addition to its historical significance to render it eligible for listing on the National Register. Further research would be required. The structure is located 50 to 75 feet east of the APE for the Concord Avenue.

- Francisco Galindo House, 1721 Amador Avenue. Built in 1856 by Francisco Galindo in a late Federal style and enlarged in the 1880s in the Eastlake mode, this is one of Concord's most significant buildings, both architecturally and historically. It has been designated a Concord Historic Landmark and may be eligible for listing on the National Register. The structure is located at least 150 feet southwest of the Concord Avenue.

- Elworthy House, 2118 East Street. A circa 1910 Prairie-style house that belonged to a former Concord mayor, the house has been designated a Concord Historic Landmark and is currently being renovated. Further research is needed to determine if it is eligible for listing on the National Register. The structure is located approximately 500 feet west of Port Chicago Highway.

- Barnett House, 2080 East Street. Another circa 1910 Prairie-style house, also designated a Concord Historic Landmark. Further research would be needed to determine whether its architectural and historical significance is sufficient to make it eligible for listing on the National Register. The structure is located approximately 500 feet west of Port Chicago Highway.

- Malty-McKinnon House, 2099 East Street. A Colonial Revival house, circa 1900. The building has been designated a Concord Historic Landmark, but would not be eligible for listing on the National Register because it has been moved from its original site. The structure is located approximately 600 feet west of Port Chicago Highway.

- Don Fernando Pacheco Adobe, 3119 Grant Avenue. The significance of this building has been recognized by its listing on the National Register (June 6, 1980) and its designation as a State Historic Landmark (No. 455). The structure is located approximately 1,300 feet west of State Route 242.

City of Pittsburg

- SPTC Railroad Station (known as Cornwall Station), at the intersection of Railroad Avenue and the SPTC line (see Appendix C, Map 5). Representative of the simplified style of late nineteenth-century commercial buildings, including railroad stations, this former SPTC Station appears to be eligible for listing on the National Register. Further research is needed to establish its place in the history of the railroad's development in Contra Costa County. The structure is located in the boundaries of the Alternative 5 Pittsburg LRT Station APE and has been adopted by the City of Pittsburg as a historical structure.

- Commercial building on Railroad Avenue next to the SPTC Railroad Station (see Appendix C, Map 5). A utilitarian commercial building stylistically related to the Southern Pacific Station and probably historically related to the Station's location. Further research would be needed to assess its eligibility for listing on the National Register. This structure is also located in the Alternative 5 Pittsburg LRT Station APE.

- California Theatre, at the intersection of Railroad and Central avenues (see Appendix C, Map 5). This circa 1930 Streamline Moderne movie house appears to meet the criteria for listing on the National Register, but would require further research to evaluate its significance. The theatre is located in the Alternative 5 Pittsburg LRT Station APE and is being rehabilitated by the City of Pittsburg.

The locations of these structures are depicted in Appendix C, Map 8.

The historic nature of the three structures located on Pacheco Street, to the west of Port Chicago Highway in Concord (the McKenzie-Collins house, the Rogers house, and the Ginnochio house), is unclear and research is required to determine if they are eligible for listing as Concord Historic Landmarks; their status as potential National Register properties is likewise uncertain. These properties are not included in the resource inventory at this time; however, depending on pending City of Concord evaluations, it may be appropriate to include them in the final historic properties survey report (to be prepared for the preferred alternative).

3.7 PARKLANDS (SECTION 4(f))

3.7.1 REGULATORY REQUIREMENTS

Because the proposed project is a major transit study, this section has been prepared following Federal Section 4(f) guidelines; however, this project will be processed in accordance with CEQA guidelines. Section 4(f) of the 1966 U.S. Department of

Transportation (DOT) Act (49 U.S.C. 1953(f)) mandates that special efforts be made to preserve the natural beauty of the countryside and public park and recreation lands, wildlife and waterfowl refuges, and historic sites. No DOT program or project which requires the use of a historic site that is listed on or eligible for the National Register of Historic Places, or any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, state, or local significance can be approved unless: (1) there is no feasible and prudent alternative to the use of those resources; and (2) the project includes all possible planning to minimize harm to the property resulting from such use.

The mechanism by which this protection is provided is the Section 4(f) evaluation, which includes a description of pertinent resources affected, impacts from project alternatives, and mitigation measures to minimize adverse effects. The Section 4(f) evaluation is circulated to federal, state, and local agencies with jurisdiction over affected resources for their consultation and comment. After receipt of all comments, a determination must be made by the lead agency that the project complies with Section 4(f) requirements.

The analysis evaluates parklands and other recreational facilities that could potentially be affected by the alternative alignments. Section 3.6 examined historic and cultural sites that could be affected.

3.7.2 DESCRIPTION OF POTENTIALLY AFFECTED PUBLIC PARK AND RECREATION RESOURCES

A field survey of the proposed alignments was conducted by Michael Brandman Associates in 1987. All potentially affected parkland sites within 0.5 mile of the alternative alignments were visited and photographed. The following discussion describes each site, beginning in downtown Concord at the current terminus of the BART line and ending in the City of Antioch at the eastern terminus of the alternative alignments. The parkland sites are identified in Exhibit 3.7-1.

<u>Port Chicago Highway Bike Route</u>

The Port Chicago Highway Bike Route is a paved, two-way bike route located in the City of Concord along, but separated from, Port Chicago Highway (Exhibit 3.7-1). The route is in moderate to good condition and was observed to be used both by bicyclists and pedestrians. It extends for approximately 2 miles from Salvio Road north to State Route 4. It is identified as a trail by the East Bay Regional Park District and is proposed to be extended north of State Route 4 along Port Chicago Highway, then east along Contra Costa Canal (Contra Costa County 1986). The bike route is within the Port Chicago Highway right-of-way directly along the proposed project route between Salvio Road and State Route 4. The proposed extension of the bike route would again cross the State Route 4 alternative alignments at the Willow Pass Road (east) offramp and follow the State Route 4 alternative alignments to Bailey Road, where it would travel south of State Route 4 and through the cities of Pittsburg and Antioch.

John F. Baldwin Neighborhood Park

The approximately 18-acre John F. Baldwin Neighborhood Park is located in the City of Concord east of and within 30 feet of Port Chicago Highway. The park is well maintained, with large grass fields, a fitness course, playground, softball field, and a bicycle/pedestrian trail through the park that connects to the Port Chicago Highway Bike Route. The park is the site of the Mount Diablo Community Child Care Center and a senior citizen's center. Access is provided from Parkside Circle via Bonifacio Street. Bonifacio Street intersects with Port Chicago Highway south of the park. There is no direct automobile access to the park from Port Chicago Highway. The City of Concord designates Baldwin Park as "parks-open space" on the general plan land use map (City of Concord 1984).

Diablo Creek Golf Course

Diablo Creek Golf Course is located in the City of Concord along the northeast intersection of Port Chicago Highway and State Route 4. The approximately 150-acre 18-hole golf course, which is owned by the U.S. Navy and leased to the City of Concord, is well used and maintained, and is designated as "parks-open space" in the city's general plan (City of Concord 1984). The southerly edge of the golf course is located along State Route 4 (Exhibit 3.7-1).

Ambrose Park

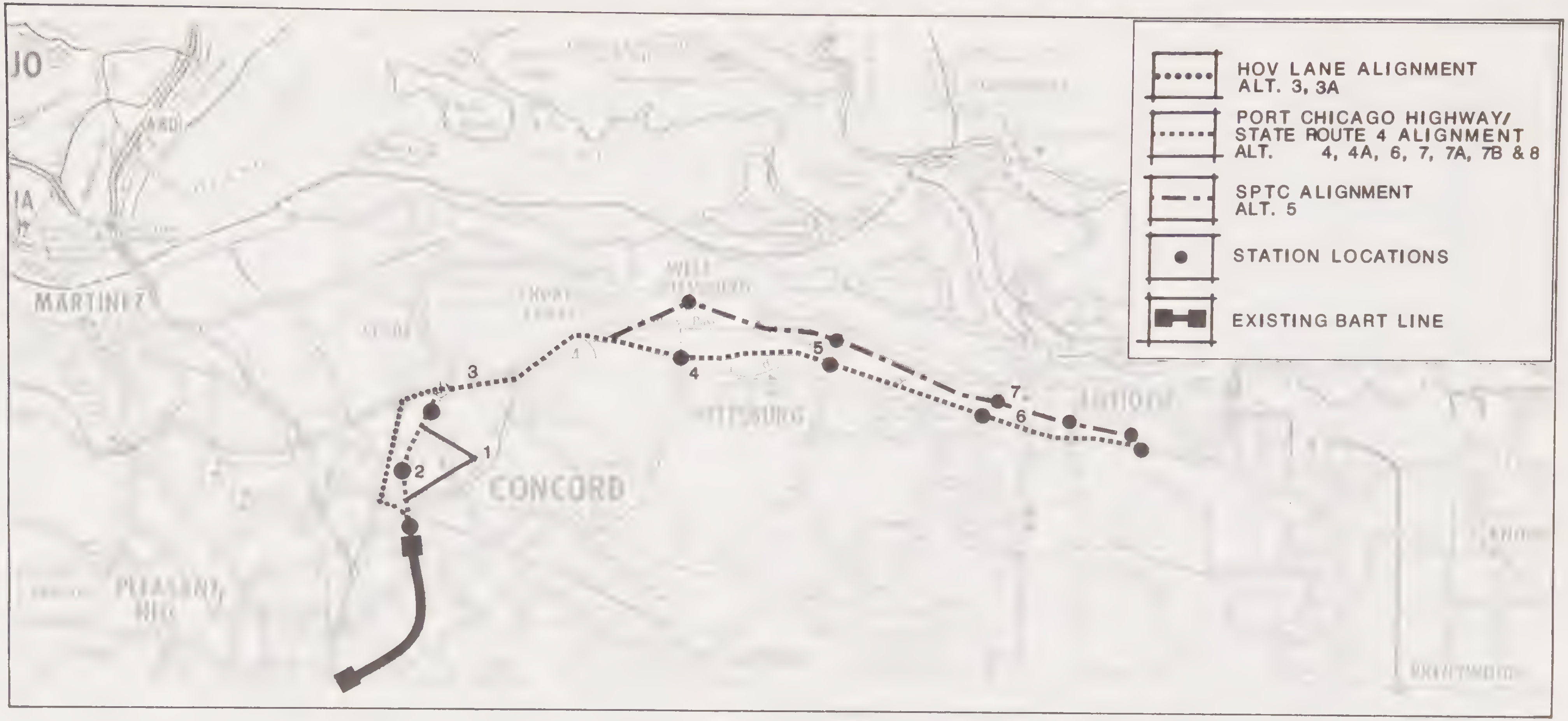
Ambrose Park is an approximately 10-acre park located south of and within 50 feet of State Route 4 in West Pittsburg (Exhibit 3.7-1). The park is well maintained, has a swimming pool, playground, and large picnic area where several large groups can be accommodated. The Ambrose Recreation and Park District offices are located on the park grounds. Regional access to the park is provided via State Route 4 at Bailey Road. Local access is via residential surface streets that eventually intersect with Bailey Road. The park is designated as a "neighborhood park" in the Contra Costa County-West Pittsburg Area General Plan (Contra Costa County 1982). It is adjacent to the State Route 4 alternative alignments.

Pittsburg City Park

Pittsburg City Park is a large, well maintained, approximately 27-acre park located in central Pittsburg across from city hall. Facilities at the park include several baseball fields, playing fields, a swimming pool, picnic facilities, and a neighborhood center. Regional access is provided via State Route 4 at Railroad Avenue; local access is gained via Railroad Avenue, Civic Avenue, Davi Avenue, and Parkside Drive. The City of Pittsburg General Plan designates the site as "parks and recreation" (City of Pittsburg 1980). The northern boundary of the park is contiguous with the SPTC line.

Contra Loma Park

Contra Loma Park is an approximately 4-acre neighborhood park located north of and adjacent to State Route 4 in the City of Antioch. Regional access to the park is provided via State Route 4 at Contra Loma Boulevard. Local access is provided via residential connector streets that intersect Contra Loma Boulevard. The park is well maintained, with a playground and play facilities, a tennis court, and a grassy field.



LEGEND

1 PORT CHICAGO HIGHWAY BIKE ROUTE
2 BALDWIN PARK
3 DIABLO CREEK GOLF COURSE
4 AMBROSE PARK
5 PITTSBURGH CITY PARK
6 CONTRA LOMA PARK
7 CONTRA COSTA DISTRICT FAIR GROUNDS

Parkland Sites

Pittsburg–Antioch Corridor AA/DEIR

North 0 1.5 3 MILES

BART

Exhibit 3.7-1

The City of Antioch General Plan designates the park as a "neighborhood park" (City of Antioch 1981).

Contra Costa District Fairgrounds

The approximately 75-acre Contra Costa District Fairground is located in the City of Antioch. Regional and local access is provided along Contra Loma Boulevard via State Route 4. The fairgrounds are operated by the county and are well maintained. The southern boundary of the site is contiguous with the LRT alternative located along the existing railroad tracks. The alternatives that are aligned along State Route 4 are approximately 0.2 mile south of the fairgrounds.

3.8 PUBLIC SERVICES AND UTILITIES

3.8.1 PUBLIC SERVICES

Police and fire protection services may be potentially affected by the transportation alternatives. Other public services are not subject to potential service demand effects (such as schools, libraries, medical services, solid waste, water use, and wastewater generation); therefore, they are not addressed in this document. Following is a discussion of police and fire protection services along the corridor.

Police Services

Police protection services along the Pittsburg-Antioch Corridor are provided by the Concord, Pittsburg, and Antioch Police Departments, the Contra Costa County Sheriff's Department (CCCSD), the California Highway Patrol (CHP), and BART Police Department.

The Concord Police Department (CPD) provides police protection and traffic enforcement within the City of Concord. The CPD currently has 135 sworn officers and approximately 64 patrol officers; 8 patrol sergeants are assigned to the Patrol Bureau. Response time to the existing BART Concord Station and the alternative stations is within approximately 6 minutes (Lynch 1987).

The Pittsburg Police Department (PPD) provides police protection services within the City of Pittsburg. The PPD currently has 57 sworn officers serving a population of 73,000. Response time to areas along the corridor and at the station sites is approximately 3 to 5 minutes (Bagwell 1987).

The Antioch Police Department (APD) provides police protection services within the City of Antioch. The APD currently has 71 officers and response time to areas along the corridor and at station sites is within approximately 5 minutes (Lewis 1987).

The CCCSD provides services to the unincorporated areas of Contra Costa County. The CCCSD also provides mutual aid to the BART Police Department. Response times to emergencies along the corridor and at station sites is approximately 2 minutes (Henderson 1987).

The CHP provides traffic enforcement on State Route 4 and State Route 242. The CHP also responds to emergencies, if needed, along Port Chicago Highway (Dalecki 1987).

The BART Police Department currently provides one officer for the three stations on the end of the Concord line. Therefore, one officer currently patrols the Concord BART station with the Pleasant Hill and Walnut Creek Stations. The BART Police Department provides police protection services along the transit line and at the BART stations. Currently, the BART Police Department does not provide service to the existing park-and-ride lots in the cities of Pittsburg and Antioch. The CCCSD provides police protection services at the existing BART park-and-ride lot at Bailey Road in the City of Pittsburg. The APD provides service to the existing BART park-and-ride lot at Hillcrest Avenue in the City of Antioch.

Fire Protection Services

The Pittsburg-Antioch Corridor is currently served by the Consolidated Fire District and the Riverview Fire District. The Consolidated Fire District provides service in the City of Concord while the Riverview Fire District provides service to Pittsburg, Antioch, and some unincorporated areas of eastern Contra Costa County.

The Consolidated Fire District has two stations that serve the area of the Pittsburg-Antioch Corridor. Station 6 is located at 2210 Willow Pass Road in Concord and is able to respond to an emergency along the corridor in 4 to 6 minutes. Station 9 is located at 209 Center Street in Pacheco. Station 9 is able to respond to an emergency along the corridor in 5 to 7 minutes (Silva 1987).

The Riverview Fire District has six stations that serve the Pittsburg-Antioch Corridor. Table 3.8-1 shows the location of each of the stations.

TABLE 3.8-1

RIVERVIEW FIRE DISTRICT STATION LOCATIONS

Station	Location
Station 81	315 W. 10th Street, Antioch
Station 82	2900 Lone Tree Way, Antioch
Station 83	2717 Gentrytown Drive, Antioch
Station 84	200 E. Sixth Street, Pittsburg
Station 85	2555 Harbor Street, Pittsburg
Station 86	3000 Willow Pass Road, West Pittsburg

Source: Thude 1987.

Initial response times of these stations to the Pittsburg-Antioch Corridor range from 1 to 8 minutes. The standard Riverview Fire District response for developments include two 3-man engine companies, one 3-man aerial ladder truck company, and one chief officer. The aerial ladder is located at Station 4 in the City of Pittsburg and response to areas along the corridor varies from 3 to 17 minutes (Thude 1987).

3.8.2 UTILITIES

A discussion of the utilities that traverse the two alignments follows. Exhibit 3.8-1 identifies the location of these facilities. In addition, there is a description of the agencies that provide utility service in the corridor study area.

Water

Water is provided in Contra Costa County by the East Bay Municipal Utility District (EBMUD) and the Contra Costa Water District (CCWD). The EBMUD provides water to western Contra Costa County through the Mokelumne Aqueduct which originates in the Mokelumne River watershed in the Sierra Nevada. The CCWD provides water to eastern Contra Costa County through the Contra Costa Canal which originates in the San Joaquin-Sacramento River Delta. The Mokelumne Aqueduct and the Contra Costa Canal extend through the cities of Antioch, Pittsburg, and Concord. These two facilities are located south of State Route 4 in the cities of Antioch and Pittsburg and cross State Route 4 near Bailey Road in West Pittsburg. The facilities extend northwest through the U.S. Naval Weapons Station, Concord, to Port Chicago Highway and then turn south. The Mokelumne Aqueduct crosses State Route 4 and extends on the west side of State Route 242 while the Contra Costa Canal crosses State Route 4 just west of Willow Pass Road in the City of Concord (Contra Costa County 1986).

Water distribution facilities and service along the corridor are provided by several purveyors. The Contra Costa Water District provides water service to the City of Concord. Several major (10-inch or larger) and minor (8-inch or less) water mains cross and parallel Port Chicago Highway (Grillo 1987).

The California Cities Water District provides water service to West Pittsburg. Currently, a 10-inch water main crosses State Route 4 at Bailey Road and a 10-inch water main extends along Willow Pass Road east of Port Chicago Highway (Leonard 1987).

The City of Pittsburg provides service to their own city. Numerous water lines cross State Route 4 and the SPTC line in the City of Pittsburg. Approximately nine water lines ranging from 6 inches to 30 inches cross State Route 4 between Bailey Road and Standard Oil Avenue. Four water lines ranging from 4 inches to 10 inches traverse the SPTC line in the vicinity of Railroad Avenue while a 6-inch line crosses the SPTC line at Harbor Street. A 10-inch line also crosses the railroad north of El Pueblo School. Various water mains in the vicinity of Standard Oil Avenue also cross the railroad and State Route 4 and are owned and maintained by companies such as Union Carbide, Dow Company, and United States Steel Company (Bedell 1987).

The City of Antioch provides service to its city. Water lines that traverse State Route 4 and the SPTC line extend along major streets such as Somersville Road, Contra Loma Road, G Street, A Street, and Hillcrest Avenue. An additional 18-inch main line traverses State Route 4 west of A Street (Wilkinson 1987).

Water lines adjacent to the alternative station sites are listed in Table 3.8-2.

TABLE 3.8-2

WATER FACILITIES ADJACENT TO STATIONS

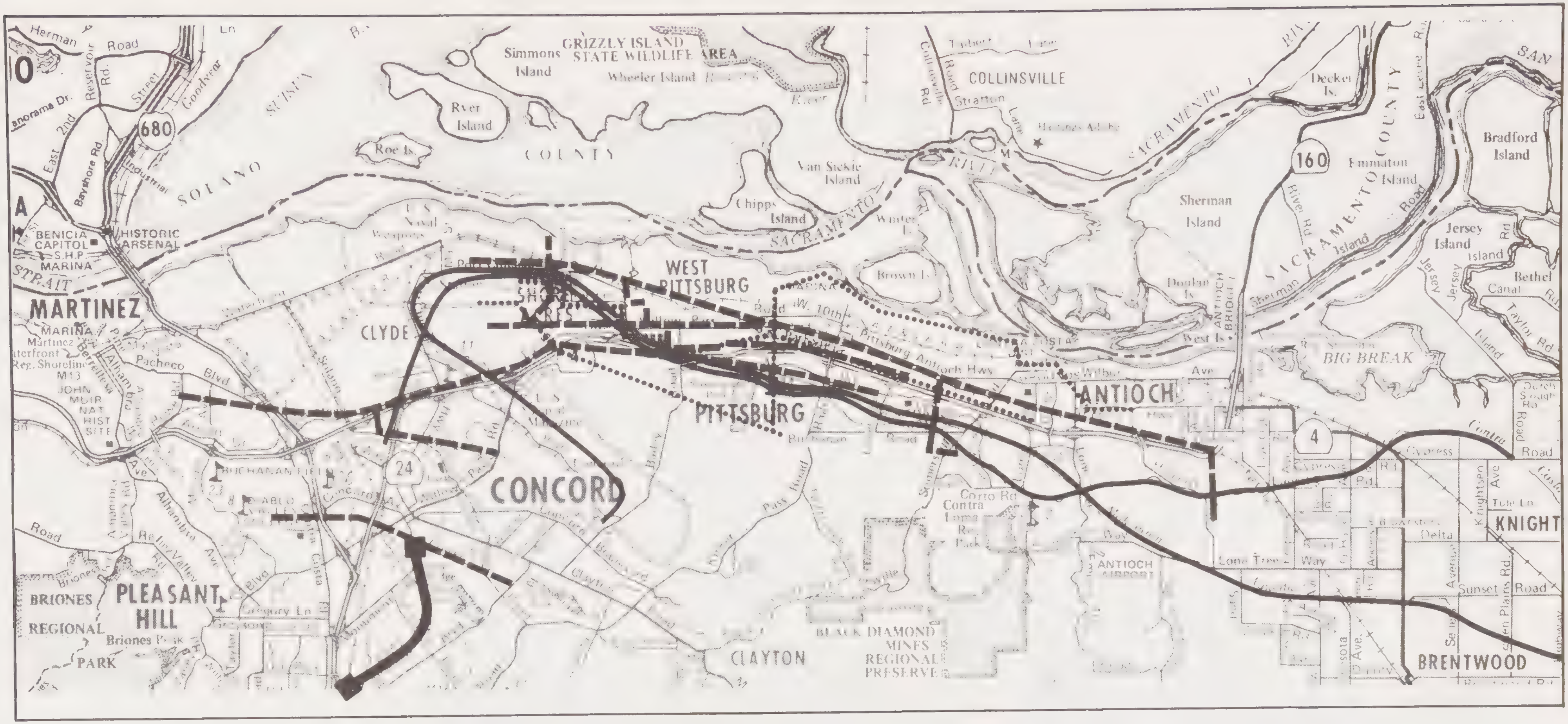
Station	Water Facility Location
A	6-inch line in Park Street
B	6-inch line in Bacon Street and 12-inch line in High School Avenue
C	8-inch line in Port Chicago Highway
D	12-inch line in Bailey Road
E	8-inch line in Willow Pass Road
F	10-inch line in Power Avenue
F(Alt)	12-inch line in California Avenue
G	4-inch and 14-inch lines in Railroad Avenue
H	14-inch line in Century Boulevard
I	14-inch line in Century Boulevard
J	8-inch line in Railroad Avenue and 18-inch line in A Street
K	8-inch line in Sunset Drive

Source: Michael Brandman Associates 1988.

Sewer

Wastewater treatment facilities along the Pittsburg-Antioch Corridor are provided by the Central Contra Costa Sanitary District and the Delta-Diablo Sanitary District. The district provides treatment for wastewater generated by the City of Concord and the unincorporated area north of Concord. The Delta-Diablo Sanitary District provides treatment of wastewater generated in the cities of Antioch and Pittsburg and the unincorporated area of West Pittsburg (Contra Costa County 1986).

Wastewater collection facilities are provided by a variety of agencies. The cities of Concord, Pittsburg, and Antioch provide their own wastewater collection facilities while the Delta-Diablo Sanitary District provides collection facilities for West Pittsburg.



Legend

OIL LINES

WATER SUPPLY FACILITIES

ELECTRICAL FACILITIES

Utility Facilities

Pittsburg-Antioch Corridor
AA/DEIR

North

0 1.5 3 MILES

BART

Exhibit 3.8-1

The City of Concord maintains numerous sewer lines that cross and parallel the corridor from the existing BART Station to State Route 4 via Port Chicago Highway. Approximately 16 sewer lines extend across the alternative alignments in the City of Concord. These sewer lines ranges from 6-inch mains to 36-inch mains (Leubner 1987).

The Delta-Diablo Sanitary District maintains sewer lines in the community of West Pittsburg. Currently, the district maintains an 8-inch sewer line along Willow Pass Road (Bruchay 1987).

The City of Pittsburg has numerous sewer lines that extend across State Route 4 and the SPTC line. Approximately five sewer lines ranging from 8 inches to 12 inches cross State Route 4 and six sewer lines ranging from 8 inches to 36 inches cross the SPTC line (Bedell 1987).

The City of Antioch has a few sewer lines that extend across State Route 4 and the SPTC line. These sewer lines extend along major roads that traverse the two alternative alignments. A 10-inch sewer also crosses State Route 4 adjacent to the Los Medanos College (Wilkinson 1987).

Sewer lines adjacent to the alternative station sites are listed in Table 3.8-3.

Electricity

The Pacific Gas and Electric Company provides electrical service within the Pittsburg-Antioch Corridor Study Area. Major electrical transmission facilities exist throughout the study area and many traverse the alternative alignments. The transmission facilities traversing State Route 4 are above ground and include a northwest to southeast line between the U.S. Naval Weapons Station, Concord, and Willow Pass Road in West Pittsburg. Another transmission line is located in West Pittsburg along Port Chicago Highway south to Willow Pass Road and east to Bailey Road. It extends along the north side of State Route 4 to Contra Loma Boulevard in the City of Antioch (Contra Costa County 1986).

There are also six above-ground electrical lines extending from two substations located in the northeastern portion of the community of West Pittsburg near Suisun Bay. The six lines cross the SPTC line and State Route 4 between Bailey Road and Railroad Avenue. In addition, a substation is located north of State Route 4 and east of the six electrical lines extending from the two substations located to the north. A substation is also located north of State Route 4 and east of Hillcrest Avenue in the City of Antioch (U.S. Geological Survey [USGS] 1980).

TABLE 3.8-3

SEWER FACILITIES ADJACENT TO STATIONS

Station	Sewer Facility Location
A	18-inch line traversing BART parking lot
B	8-inch line in High School Avenue
C	6-inch line in Port Chicago Highway
D	8-inch line in Bailey Road
E	8-inch line in Willow Pass Road
F	10-inch line in Railroad Avenue
F(Alt)	6-inch line south of MacArthur Avenue
G	8-inch line in Railroad Avenue
H	54-inch line in Century Boulevard
I	54-inch line in Century Boulevard
J	8-inch and 6-inch lines in Railroad Avenue
K	8-inch line in Sunset Drive

Source: Michael Brandman Associates 1988.

Oil

Numerous oil lines cross the Pittsburg-Antioch Corridor Study Area. The Union Oil, Getty Oil, Standard Pacific, Standard Oil, and Shell Oil companies currently have major oil lines within the corridor. Union Oil, Getty Oil, and Standard Pacific own oil lines extending east to west that cross Port Chicago Highway at Olivera Road. Standard Pacific also has a line along State Route 4 from Port Chicago Highway to Willow Pass Road in West Pittsburg and extends across State Route 4 between Bailey Road and Railroad Avenue. Standard Oil owns one major line that extends along the SPTC line from Port Chicago Highway in West Pittsburg to G Street located in the City of Antioch. Shell Oil also owns two lines extending along the SPTC line from Willow Pass Road in West Pittsburg to G Street in the City of Antioch. At Standard Oil Avenue in Pittsburg, a lateral Shell Oil line extends south across State Route 4 (Contra Costa County 1987).

3.9 GEOLOGY, SOILS, AND SEISMICITY

3.9.1 GEOLOGY/TOPOGRAPHY

The Pittsburg-Antioch Corridor Study Area lies within the northern part of Contra Costa County, just south of Suisun Bay. The corridor is characterized by alluvial plains and deltaic lowlands. Hilly terrain in the southern portion of the corridor area and at Willow Pass (the segment of State Route 4 between Mallard Reservoir and West Pittsburg) results from uplifted belts of bedrock trending in a northwest-southeast direction. Relief ranges from near sea level along the marshy lowland areas fronting the Suisun Bay, to over 1,000 feet in the foothills of the Mount Diablo

Range to the south. Streams drain northward into the San Joaquin River and Suisun Bay. A few small streams drain west into San Francisco Bay and San Pablo Bay (U.S. Department of Agriculture, Soil Conservation Service [USDA-SCS] 1977).

The corridor consists of three distinct geologic environments. These include Holocene (younger) alluvium, Pleistocene (older) alluvium, and Tertiary sedimentary rocks. Younger alluvium underlies much of the corridor in the cities of Concord, Pittsburg, and Antioch. It consists of unconsolidated floodplain deposits of clay, silt, sand, and gravel (Sims et al. 1973).

Older alluvium underlies portions of the corridor in the City of Concord and in the West Pittsburg area. It consists of unconsolidated floodplain and fan deposits of clay, silt, sand, and gravel (Contra Costa County CDD 1975).

Tertiary sedimentary rocks are present along State Route 4 in the Willow Pass Grade and West Pittsburg areas. These rocks consist of poorly consolidated siltstones, shales, and conglomerates of the Tehama (or Wolfskill) Formation and the relatively well consolidated sandstones and shales of the Markley Sandstone Member of the Kreyenhagen Formation.

Minor amounts of Lawlor Tuff and Neroly sandstone are also present along Willow Pass Grade. In addition, sandstones, shales, and graywackes of the Cierbo and Briones sandstones occur within the corridor but do not appear to underlie the alternative alignments.

3.9.2 SOILS

The most extensive soil groups that underlie and surround the corridor are the Altamont, Antioch, Botella, Capay, Clearlake, Conejo, Diablo, Rincon, and Zamora Series (USDA-SCS 1977). These soils overly the geologic units described in Section 3.9.1 and range from about 4 feet to 15 feet in thickness. The soils consist of variable amounts of silt, clay, and loam. Engineering properties of these soils, such as erosion and shrink-swell potential, are shown in Table 3.9-1.

3.9.3 GROUNDWATER

Very little groundwater level data for Contra Costa County are currently available in the published literature. However, discussions with county personnel have provided information on groundwater conditions within the study area (Spare 1987). In general, shallow perched water table conditions exist in the City of Concord, West Pittsburg, and City of Pittsburg. In these areas, water is often encountered at depths of 10 to 20 feet below ground surface. Water levels are generally at shallower depths toward the San Francisco Bay. The occurrence of shallow water results from presence of an extensive, confining clay lens, which acts to retard downward vertical migration of surface water.

TABLE 3.9-1

ENGINEERING PROPERTIES OF SOIL TYPES UNDERLYING THE CORRIDOR

Soil Series[a]	USC Classification[b]	Runoff Rate	Erosion Potential	Shrink-Swell Potential	Atterberg Limits Liquid Limit (%)	Atterberg Limits Plasticity Limit (%)
Altamont	CL			High	40-50	25-30
AbD		Medium to slow	Slight to moderate			
AbE		Medium	Moderate			
AcF		Medium to rapid	Moderate to high			
Antioch	CL to ML			Low to high	25-50	5-30
AdA		Slow	Slight			
AdC		Slow to medium	Slight to moderate			
Botella	CL			Moderate	30-40	15-20
BaA		Very slow	Slight			
Capay	CL			High	40-50	25-30
CaA		Slow	None			
CaC		Slow	Slight			
Clear Lake	CL	Slow	None	High	40-50	25-30
Cc		(subject to flooding)				
Conejo	CL			Moderate to high	30-50	10-30
CeA		Slow	None			
ChA		Slow	None			
Diablo	CL			High	40-50	25-30
DdD		Slow to medium	Slight to moderate			
DdE		Medium	Moderate			
DdF		Medium to rapid	Moderate to high			
Rincon	CL			Moderate to high	25-40	10-25
RbA		Slow	Slight			
RbC		Medium	Slight			
RbD		Medium to rapid	Moderate to severe			
Zamora	CL to ML					
ZaA		Slow	None	Moderate	30-40	5-20

a Soil series and associated engineering properties taken from USDA 1974.
b Unified Soil Classification, adopted by U.S. Army Corps of Engineers and U.S. Bureau of Reclamation 1952.

Regional groundwater occurs in Contra Costa County below the confining clay lens. In Clyde, a municipal well encountered three aquifer systems at depths of about 50 feet, 100 feet, and 150 feet below ground surface. The confining clay lens becomes less prominent in the easterly direction and is not present in the City of Antioch. Water levels in the City of Antioch represent the regional groundwater table, which occurs at approximately 150 to 250 feet, or elevations of about -100 to -200 feet mean sea level.

Based on previous soils studies, it is known that the Clear Lake Clay is subject to flooding unless surface drainage is provided (USDA-SCS 1977). Therefore, groundwater flooding may occur along Port Chicago Highway where the Clear Lake clays are present (Control Costa County CDD 1975), and along State Route 4 where younger alluvial stream deposits underlie the highway. The outlets of subsurface drains were observed along Port Chicago Highway during a field reconnaissance, suggesting that this area may be subject to flooding.

3.9.4 SEISMIC ACTIVITY

Contra Costa County is located within a seismically active area. Active faults in the region include the San Andreas, Hayward, and Calaveras faults. Locally active faults, the Antioch and Concord, cross the corridor. These fault systems are zoned for fault rupture studies under the Alquist-Priolo Special Studies Zone Act (Chapter 7.5, Division 2 of the California Public Resources Code). Exhibits 3.9-1 and 3.9-2 show the proximity of the corridor to regional and local active faults.

In Contra Costa County, earthquake damage is caused primarily by ground surface rupture, groundshaking, and liquefaction. These phenomena are responses to earthquakes and are dependent on the proximity of the causative fault, earthquake parameters (such as magnitude, frequency, and duration), and physical characteristics of the geologic materials. Groundshaking and liquefaction potential is relatively high in Contra Costa County due to the poorly consolidated and sometimes saturated condition of the geologic units.

3.9.5 EXISTING WASTE DISPOSAL SITES

Three sanitary landfills are currently operating in Contra Costa County. One landfill (Acme Sanitary Landfill) is located on Waterbird Way in Martinez, approximately 7 miles from the Pittsburg-Antioch Corridor. Contra Costa Waste Sanitary Landfill is located on Somersville Road in Antioch, approximately 2 miles from the corridor. West Contra Costa Sanitary Landfill is located at the end of Garden Tract Road in Richmond, approximately 17 miles from the corridor. West Contra Costa Sanitary Landfill includes a 30-acre hazardous waste disposal site as well as a 200-acre Class III landfill (Blake 1988).

3.10 ECOSYSTEMS

The biotic composition of the project corridors is described from information compiled through field reconnaissance and supplemented by existing documentation of biological resources. The potential alignments were surveyed on foot and by vehicle by Michael Brandman Associates in June 1987. Floral constituents encountered were recorded in terms of relative abundance and habitat type. Faunal constituents were determined by field observation and an analysis of regional wildlife species that are likely to occur in the observed habitats based on documented habitat preferences of all species known to occur in the region. Aerial photographs and USGS 1:24,000 topographic maps were used to supplement this analysis and for mapping biotic communities.

Habitat designations used in this report are according to the classification system of Munz and Keck (1959) as amplified by Axelrod (1978). Floral taxonomy used follows the current checklist of Kartesz and Kartesz (1980). Vertebrates identified in the field by sight, calls, tracks, scat, or other signs are cited according to the nomenclature of Jennings (1983) for amphibians and reptiles; American Ornithologists Union (1983) for birds; and Jones et al. (1982) for mammals.

Sources used for determination of sensitive wildlife include: U.S. Fish and Wildlife Service (USFWS) 1987; California Natural Diversity Data Base (CNDDB) 1987; California Department of Fish and Game (CDFG) 1980, 1986; and Remsen 1978. For plants, sources included USFWS 1987, CDFG 1987, CNDDB 1987, and Smith and York 1984; and for habitats CNDDB 1987.

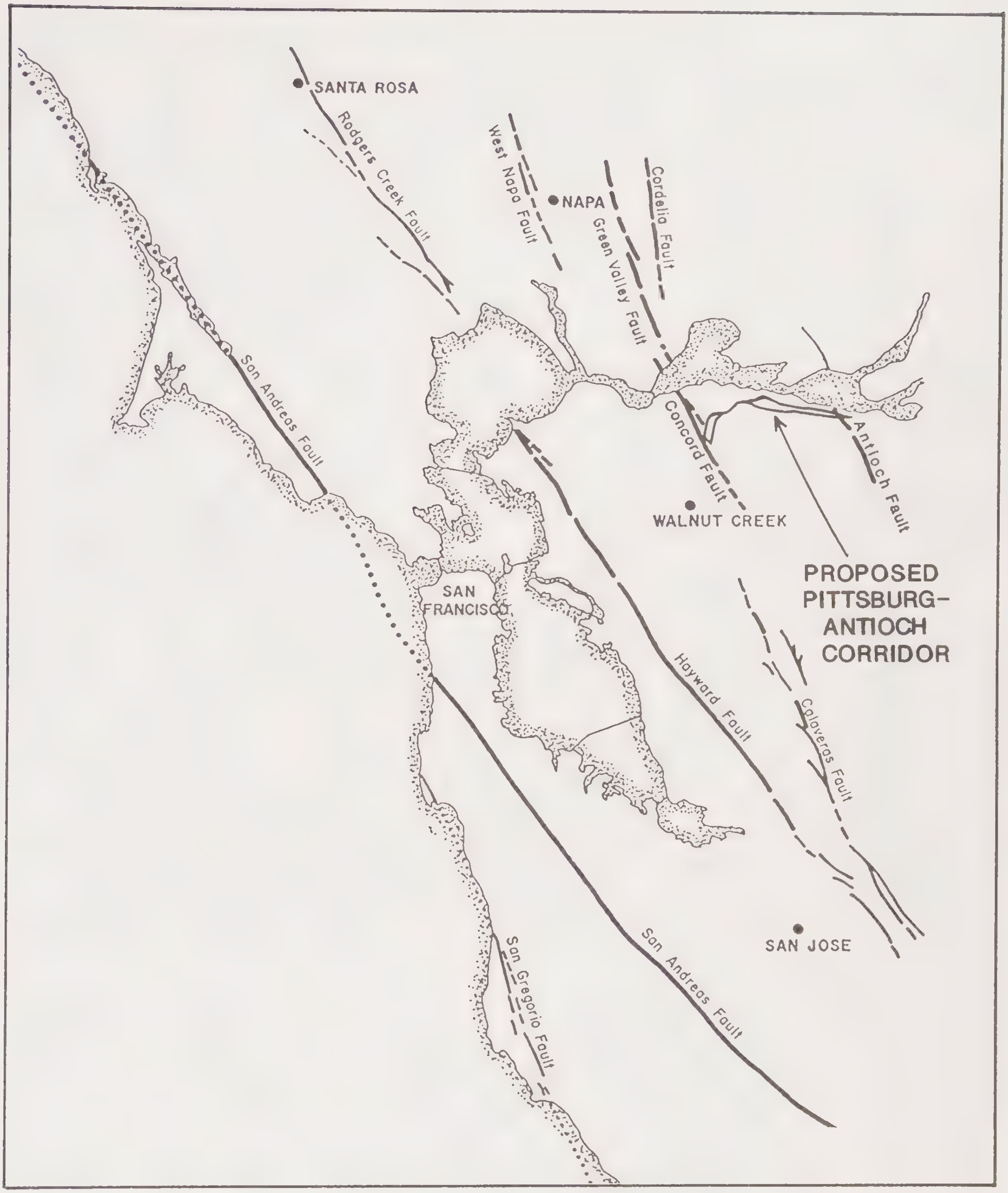
3.10.1 EXISTING VEGETATION IN POTENTIALLY AFFECTED AREAS

Summary of Major Plant Groups

The alternative alignments lie within areas that have been largely altered from their natural condition by agriculture and urbanization. As a result, the vegetation is relatively limited in diversity, and can be divided into two main groups: (1) the freshwater aquatic/riparian plant community found along drainage ditches and other areas of permanent to semi-permanent moisture and, (2) the annual grassland/ruderal plant community found in grazed areas, rights-of-way, and abandoned lots.

Freshwater Aquatic/Riparian Plant Communities

Freshwater aquatic/riparian plants have developed in areas where permanent or semi-permanent water collects, providing the moisture required for these plant species. In the urban and agricultural areas, this plant community is frequently found in irrigation ditches or storm drains and is represented by several small areas (less than 0.25 acre) dominated by cattails (*Typha* spp.). Other species found in these small wetland pockets include bulrush (*Scirpus* spp.), umbrella-plant (*Cyperus alternifolius*), Johnsongrass (*Sorghum halepensis*), rabbits-foot grass (*Polypogon monospelensis*), and curly dock (*Rumex crispus*). A few better developed wetlands occur where more moisture is available during the year. These areas support willow (*Salix* spp.), giant reed (*Arundo donax*), blackberry (*Rubus ursinus*), and an occasional Fremont's cottonwood (*Populus fremontii*). These freshwater aquatic/riparian plant communities potentially affected by the alternatives are summarized in Table 3.10-1.



SOURCE: HELLEY, E.J. AND HERD, D.G., 1977 AND CALIF. DIV. OF MINES AND GEOLOGY "SPECIAL STUDIES ZONE MAPS" FOR WALNUT CREEK, ANTIOCK NORTH, ANTIOCH SOUTH, AND PORT CHICAGO QUADRANGLES, 1974-1977

Regional Active Faults And Potentially Active Faults

Pittsburg-Antioch Corridor AA/DEIR

Legend

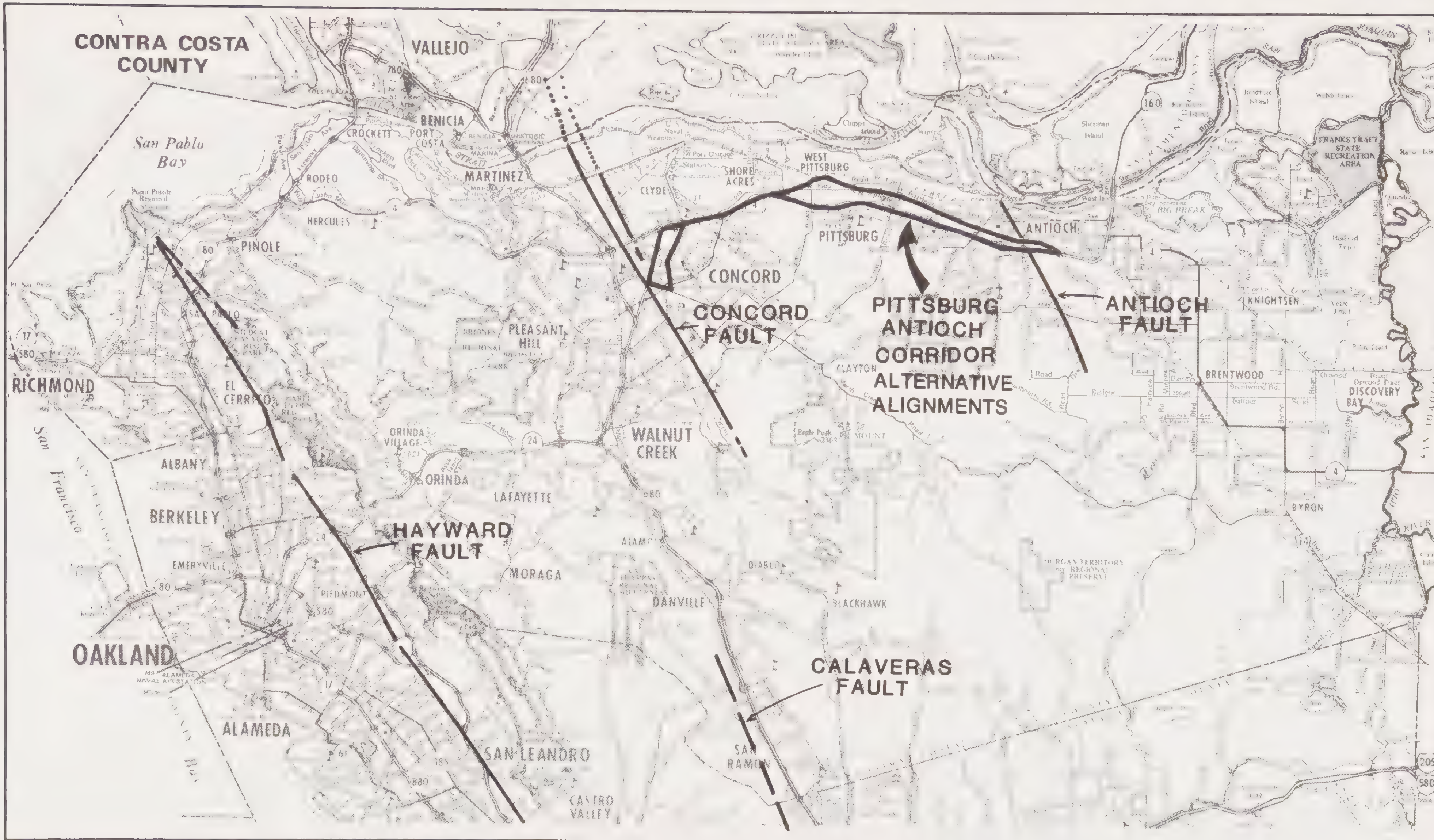
FAULT SHOWING HISTORIC MOVEMENT, HISTORIC SEISMICITY, SURFACE RUPTURE OR CREEP DASHED WHERE DISCONTINUOUS OR APPROXIMATELY LOCATED

FAULT TRACE UNDER WATER

North 0 7.5 15 MILES

BART

Exhibit 3.9-1



SOURCE: GEO/RESOURCES CONSULTANTS, INC. 1988

Locally Active Faults
And Potentially Active Faults
Pittsburg–Antioch Corridor
AA/DEIR

Legend

FAULT SHOWING HISTORIC MOVEMENT, HISTORIC SEISMICITY, SURFACE RUPTURE OR CREEP DASHED WHERE DISCONTINUOUS OR APPROXIMATELY LOCATED

FAULT TRACE UNDER WATER

North 0 2.5 5 MILES

BART

Exhibit 3.9–2

TABLE 3.10-1

FRESHWATER AQUATIC/RIPARIAN PLANT COMMUNITIES
POTENTIALLY AFFECTED BY THE ALTERNATIVE ALIGNMENTS

Location[a]	Size	Description
State Route 4 Alternatives (3,3A,4,4A,6,7,7A,7B, and 8)		
1. State Route 4 and Mount Diablo Creek.	Approximately 4.0 acres (extending south of the project alignment).	Cattails, rushes, and scattered willows; moderate wildlife value.
2. State Route 4, eastern slope of Willow Pass Road (not in the potential construction corridor).	Approximately 1.0 acre.	Cattails, rushes and immature willows; moderate wildlife value.
3. State Route 4 at Willow Pass Road, east of the summit and south of the potential construction corridor.	Approximately 1.0 acre.	Declining willow woodland; low wildlife value.
SPTC Line Alternative (5)		
4. USGS unnamed blueline (stream) west of North Broadway Avenue.	Approximately 0.75 acre.	Mature declining willow woodland and adjacent cattail; low to moderate wildlife value.
5. Along SPTC line from unnamed blueline to North Broadway Avenue.	Approximately 1.25 acre.	Cattail, blackberry, declining willows; moderate wildlife value.
6. SPTC line and unnamed blueline (stream) (crosses corridor).	Approximately 0.25 acre.	Dense vegetation with large willows; moderate wildlife value.
7. Along SPTC line, Parkside Drive, and unnamed blueline (stream).	Approximately 0.3 acre.	Cattail and giant reed; moderate wildlife value.
8. Along SPTC line and Mildred Avenue.	Less than 0.10 acre.	Giant reed and blackberry; low wildlife value.

JBX/4580001E1x

TABLE 3.10-1 (Continued)

Location	Size	Description
9. SPTC line and Loveridge Road.	Approximately 0.25-0.5 acre.	Cattails with some willows and cottonwoods; moderate to high wildlife value.
10. SPTC line and Manzanita Way, south of corridor.	Approximately 0.25 acre.	Cattails; moderate wildlife value.

a Numbers indicate locations shown on Exhibit 3.10-1.

Source: Michael Brandman Associates, Inc. 1988.

In addition to the small aquatic and riparian habitats listed in Table 3.10-1 and shown in Exhibit 3.10-1, a large marsh is located approximately 100 feet from the western end of the SPTC alignment. This marsh area parallels the tracks eastward for approximately 0.5 mile, but its boundary runs to the northeast away from the potential alignment. This area contains ponds surrounded with cattails and other aquatic vegetation. The marsh appears to be artificially maintained by a series of dikes and levees.

Annual Grassland/Ruderal

Grasslands occur on a variety of soils along the project corridor, most of which are medium to heavy in texture, granular in structure, and moderate in organic matter content. Many of the grasslands in these areas have been converted from other plant communities such as areas of cleared scrub and woodland, and from wetlands that have been filled. These grasslands are dominated by introduced, annual species that are often ruderal (weedy) in nature.

Small, highly disturbed grasslands are common along all alignments. Several large areas of grassland occur adjacent to State Route 4 in the Willow Pass Grade area. The dominant grass species are wild oats (Avena spp.) and brome grasses (Bromus spp.). Other annual, ruderal plants common throughout the disturbed grasslands are dove weed (Eremocarpus setigerus), wild radish (Raphanus sativa), and tocalote (Centaurea melitensis). No native grass species were encountered during the present survey.

A number of these grassland/ruderal areas, especially those along Port Chicago Highway and the SPTC line right-of-way, contain mature trees. Scattered walnuts (Juglans sp.), coast live oaks (Quercus agrifolia), valley oak (Q. lobata), and eucalyptus (Eucalyptus spp.) windrows are found in ruderal/grassland areas along both alignments.

Rare and Endangered Plant Species

No plant species listed as rare, threatened, or endangered by federal, state, or local agencies were located during the present survey. Nine sensitive plant species may occur in the region (Table 3.10-2); however, none of these sensitive species are expected to occur along the alignments because suitable habitat is either not present or, if present, is sufficiently disturbed so as to exclude these species. Two of these species, the diamond-petaled poppy and the caper-fruited tropidocarpum, have not been recorded in the area since the late 1800s (CNDDB 1987).

TABLE 3.10-2

SENSITIVE PLANT SPECIES KNOWN OR POTENTIALLY OCCURRING IN THE VICINITY OF THE ALTERNATIVE ALIGNMENTS

Species	Status[a] USFWS	CDFG	CNPS	Habitat
Aster chilensis var. lentus Suisun marsh aster	Category 2[b]	--	List 1[c]	Coastal salt marsh
Cordylanthus mollis ssp. mollis soft bird's beak	Category 1[d]	Threatened[e]	List 1	Coastal salt marsh
Erysimum capitatum var. angustatum Contra Costa wallflower	Endangered[f]	Endangered[g]	List 1	Coastal strand
Eschscholzia rhombipetala diamond-petaled poppy	Category 2	--	List 1	Valley grassland
Helianthella castena Diablo helianthella	Category 2	--	List 1	Valley grassland
Lathyrus jepsonii ssp. jepsonii Delta tule pea	Category 2	--	List 1	Freshwater marsh
Lililaeopsis masonii Mason's liliaeopsis	Category 1	Endangered	List 1	Coastal salt marsh
Oenothera deltoides var. howellii Antioch Dunes evening primrose	Endangered	Endangered	List 1	Coastal dunes
Tropidocarpum capparideum caper-fruited tropidocarpum	Category 2	--	List 1	Valley grassland

a Listing agencies/organizations:
USFWS - U.S. Fish and Wildlife Service
CDFG - California Department of Fish and Game
CNPS - California Native Plant Society

b Federal Category 2 candidate - decline of the species is suspected; however, insufficient data exist to support a proposed listing.

c Considered rare and endangered throughout its range.

d Federal Category 1 candidate - sufficient data exist to support a proposed listing.

e State-listed threatened.

f Federally listed endangered.

g State-listed endangered.

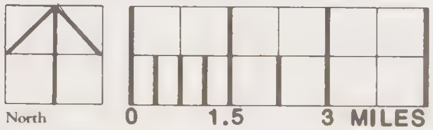
Source: Michael Brandman Associates, Inc. 1988.

LEGEND

1–10 NUMBERS CORRESPOND TO TABLE IN THE TEXT

Aquatic/Riparian Plant Communities Along Alignments

Pittsburg–Antioch Corridor AA/DEIR



BART

Exhibit 3.10–1

3.10.2 EXISTING WILDLIFE IN THE CORRIDOR STUDY AREA

Freshwater Aquatic/Riparian Habitats

Freshwater aquatic/riparian habitats can be areas of great faunal concentration. Many invertebrate and lower vertebrate species complete their life cycles in this setting; higher vertebrates utilize the habitat for water and to feed upon the wetland-dependent biota. In addition, the vegetation in these areas provides protective cover, enhancing its value to wildlife.

A number of amphibians, such as the Pacific treefrog, western toad, and the California slender salamander, are expected in most of the freshwater wetland areas. Reptiles present may include common species such as the western fence lizard, southern alligator lizard, the western aquatic garter snake, and the ringneck snake. Typical bird species that may occur in the small areas of habitat found in the vicinity of the alignments include the common yellowthroat, redwinged blackbird, song sparrow, American goldfinch, and bushtit. Wading birds and other marsh-edge species (e.g., the Virginia rail, sora, great blue heron, great and snowy egrets, and black-crowned night-heron) will utilize the larger, less disturbed cattail stands as well. Small mammals present may include the broad-footed mole, western harvest mouse, and California vole. Larger mammals may include the Virginia opossum, raccoon, and skunk.

Annual Grassland/Ruderal Habitats

The grassland plant community provides important foraging habitat for a number of wildlife species. Numerous reptiles are expected to occur in this habitat and include the western fence lizard, western skunk, southern aligator lizard, racer, gopher snake, common kingsnake, and western rattlesnake. A number of bird species commonly inhabit this type of grassland. Among these species are the western meadowlark, horned lark, lark sparrow, savannah sparrow, loggerhead shrike, Say's phoebe, and western kingbird. Virtually all the terrestrially foraging raptors, especially the prairie falcon, American kestrel, northern harrier, black-shouldered kite, red-tailed hawk, and golden eagle, forage in the grassland. In addition, a variety of owl species, the turkey vulture, American crow, and common raven forage in this community. Grassland mammals include an abundance of small rodents, such as the California vole, harvest mouse, house mouse, Botta's pocket gopher, deer mouse, and southern grasshopper mouse. Medium-sized mammals include the California ground squirrel and desert cottontail. Coyotes are common predators in this community.

Rare and Endangered Wildlife Species

No wildlife species listed as rare, threatened, or endangered by any federal, state, or local agency were observed during the field survey. Fourteen sensitive species (Table 3.10-3) may occur in the region, but are not expected to breed or occur with any regularity within or adjacent to the alignments because suitable habitat is either not present or highly disturbed. However, of the 14 sensitive wildlife species potentially occurring in the vicinity of the alternative alignments, 9 are bird species which may, on rare occasions, utilize either the grassland or freshwater aquatic/riparian habitats of the area.

TABLE 3.10-3

SENSITIVE WILDLIFE SPECIES KNOWN OR POTENTIALLY OCCURRING IN THE VICINITY OF THE ALTERNATIVE ALIGNMENTS

Species	Status[a] USFWS	CDFG	Habitat
Alameda striped racer Masticophis laterolis euryxanthus	Category 2[b]	Threatened[c]	Scrub and grasslands
American peregrine falcon Falco peregrinus anatum	Endangered[d]	Endangered[e]	Coastal cliffs
Black-shouldered kite Elanus caeruleus	Fully Protected	--	Nests in riparian woodlands; forages in grasslands
California black rail Laterallus jamaicensis corturniculus	Category 2	Threatened	Coastal salt marsh
California clapper rail Rallus longirestris obsoletus	Endangered	Endangered	Coastal salt marsh
California least tern Sterna antillarum browni	Endangered	Endangered	Estuaries, sandy beaches
California tiger salamander Ambystoma tigrinum californiense	Category 2	--	Temporary rain pools and permanent waters of grassland and open woodland
Golden eagle Aquila chrysaetos	Fully Protected under Bald Eagle Act	--	Forages in grasslands
Long-billed curlew Numenius americana	Category 2	--	Mudflats, marshes
Saltmarsh harvest mouse Reithrodontomys raviventris	Endangered	Endangered	Coastal salt marsh
Saltmarsh yellowthroat Geothlypis trichas sinuosa	Category 2	--	Riparian woodland, marsh
San Joaquin pocket mouse Perognathus inornatus inornatus	Category 2	--	Grasslands
Snowy plover Charadrius alexandrinus nivosus	Category 2	--	Sandy beaches
Suisun shrew Sorex ornatus sinuosis	Category 2	Special Concern[f] Priority 1	Coastal salt marsh

a Listing agencies:
USFWS-U.S. Fish and Wildlife Service
CDFG - California Department of Fish and Game
b Federal Category 2 candidate - decline of the species is suspected; however, insufficient data exist to support a proposed listing.
c State-listed threatened.
d Federally listed endangered.
e State-listed endangered.
f State species of special concern, Priority 1 - species is considered threatened due to small population size and habitat disruption.

Source: Michael Brandman Associates, Inc. 1983.

3.10.3 SIGNIFICANT ECOLOGICAL RELATIONSHIPS

The biological resources contained in the vicinity of the potential alternative alignments have been degraded and fragmented by past land uses. Some areas of grassland found along State Route 4 in the Willow Pass Grade area function as good raptor foraging habitat and some of the small freshwater aquatic/riparian areas discussed in Section 3.10.1 provide habitat for birds. The larger of these habitats are of some regional value because they are a portion of the total ecosystem dominated by Suisun Bay and the San Joaquin River. These grasslands and freshwater wetland habitats add to the cumulative habitat diversity of the region and contribute to the region's ability to support wildlife species.

3.10.4 WETLANDS

Habitats along the alternative alignments that may meet the definition of "wetlands" pursuant to Section 404 of the Clean Water Act are described in Section 3.10.1 under the discussion of freshwater aquatic/riparian plant communities.

Although freshwater aquatic and riparian habitats were historically abundant throughout the region, development has reduced existing wetlands to small areas within manmade drainage ditches or greatly altered stream channels. The wetlands in the vicinity of the alternatives are small, fragmented, and isolated from the major marsh habitats along Suisun Bay and the San Joaquin River. However, they do provide resting and foraging areas between major wetland habitats for many bird species. Therefore, although each is of minor importance individually, these small aquatic and riparian habitats are valuable in their relationship to the larger bay/river system.

3.11 HYDROLOGY AND WATER QUALITY

3.11.1 REGULATORY ENVIRONMENT

Surface and groundwater quality is regulated in the state by the Federal Water Pollution Control Act and the State Porter-Cologne Water Quality Act. The State Water Resources Control Board administers the activities of these laws which are based on the policy of nondegradation of water quality from discharges of contaminants into the waters of the state. Surface water discharges from point sources require that a National Pollutant Discharge Elimination System permit be obtained prior to initiating activities that could cause a release.

Waters of the state must also meet State Water Quality Standards and any discharges to these waters must not degrade the existing water quality of the receiving body below these standards. The Contra Costa County Water District has jurisdiction over the Contra Costa Canal and any other water supply canals or pipelines in the area. Approval to cross or initiate activities that would affect the canal or its water flow or quality must be approved by the district.

Activities that occur within floodplains and flood areas are regulated on the federal level by the Clean Water Act, Rivers and Harbors Act, and Executive Order 11988, Floodplain Management. In addition, the Federal Emergency Management Agency (FEMA) provides flood insurance maps that identify the designated flood waters and floodplains in most metropolitan areas. Executive Order 11988 requires that each federal agency be responsible for evaluating the potential effects of any actions it may take in a floodplain. Each such agency shall determine whether the proposed action will occur in a floodplain and identify the anticipated impacts. For construction of non-federal and non-federally aided structures that encroach upon or affect the base floodplain, local agencies may have authority. If the project is to be constructed in a floodplain, action must be incorporated either through designs or modification to minimize the potential harm to or within the floodplain. Therefore, any work planned in a floodplain or wetland will be assessed and be approved by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency (EPA) prior to initiating construction activities.

Contra Costa County's Ordinance No. 88-50 outlines construction standards for residential and nonresidential projects within the 100-year floodplain for unincorporated areas within the county. Incorporated areas, in this case the cities of Concord, Pittsburg, and Antioch, have adopted FEMA requirements under their own municipal codes. These are: Concord--Chapter IX.1(3), Section 9130, Flood Insurance Program, enabled most recently through "urgency ordinance" No. 84-14; Pittsburg--Chapter 15.80, Flood Hazard Prevention, amended most recently by Ordinance No. 87-933; and Antioch--Chapter IX, Section 5.413.1, Floodway and Flood Fringe Combining District.

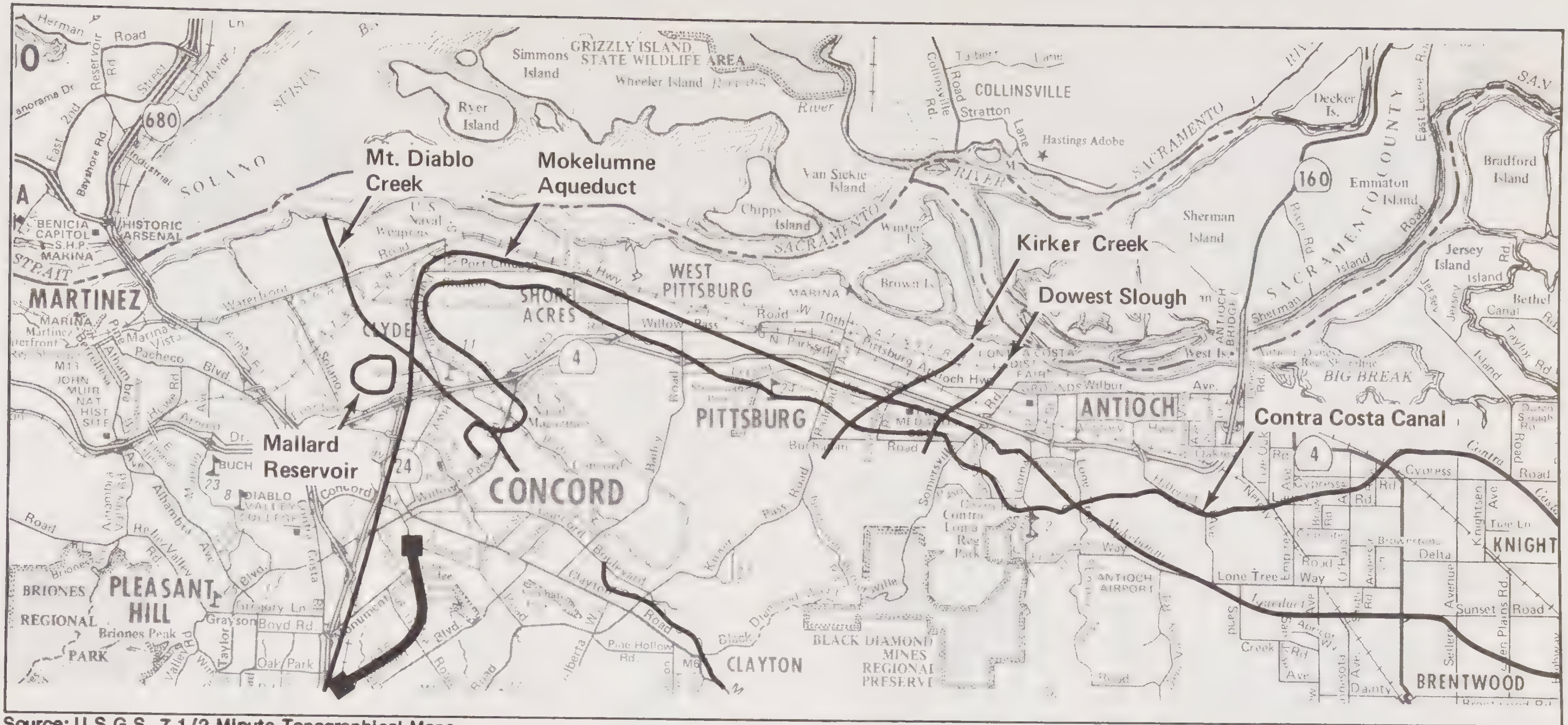
3.11.2 SURFACE WATERS

The surface water bodies in Contra Costa County consist primarily of intermittent streams and water canals. Mallard Reservoir is located in the northwest portion of the corridor, west of the junction of Port Chicago Highway and State Route 4. The alternative alignments cross a number of streams, the Contra Costa Canal, and the Mokelumne Canal. A list of these stream crossings follows:

Contra Costa Canal	Walnut Creek
Mokelumne Aqueduct	Unnamed Creek (9)
Mallard Reservoir	Kirker Creek
Clayton Canal	Los Medanos Wasteway
Dowest Slough	Contra Loma Reservoir
Lawlor Ravine	Antioch Reservoir
Mount Diablo Creek	Markley Canyon

Exhibit 3.11-1 presents the location of these streams and canals with respect to the alternative alignments.

The alternative alignments cross through four different major drainage basins in Contra Costa County. These drainages include Walnut Creek, Mount Diablo, Port Chicago, and Antioch. These drainages flow in a south to north direction and drain into the Suisun Bay and San Joaquin River.



Source: U.S.G.S. 7 1/2 Minute Topographical Maps

Legend

WATERWAYS

Location Of Major Water Bodies
Pittsburg-Antioch Corridor
AA/DEIR

North 0 1.5 3 MILES

BART

Exhibit 3.11-1

The corridor also lies within two hydrographical areas, Suisun Bay and the Western Sacramento-San Joaquin Delta. In addition, the corridor is also part of two water quality regions, the San Francisco Bay Basin and the Central Valley Basin.

Annual rainfall in the corridor ranges between 13 and 30 inches per year (U.S. Department of Commerce 1983). The greatest amount of precipitation occurs during the winter months with the summer months being relatively dry. The evaporation rate for the corridor also varies throughout the county with a mean rate of 65 inches per year. This leaves a deficit of -35 inches of water; therefore, there is minimal groundwater recharge.

The surface water quality of Contra Costa County reflects a more urban environment. Water quality monitoring stations along Marsh Creek (north of the study area) indicate the water (when flowing) is at times excellent in quality (State of California 1972). It is apparently low in carbonate and minerals. However, many of these streams are subject to flow only during the winter months and the water quality can change from season to season. In general, the surface waters in the study area are not critical to recreation or water supply but are biologically important especially related to wetland or floodplain values (California State Lands Department 1986).

The Mokelumne Aqueduct is a three-pipeline system owned and operated by the East Bay Municipal Utilities District. The pipelines sizes are 65 inches, 67 inches, and 87 inches. The capacity of the aqueduct varies from gravity flow (202 million gallons per day [mgd]) to pumped flow (326 mgd). The aqueduct is approximately 100 miles long, originating at Pardee Reservoir and terminating in Walnut Creek. This aqueduct serves approximately 1.1 million domestic customers (Mizuno 1988).

The Contra Costa Canal is owned by the U.S. Bureau of Reclamation and operated by the Contra Costa Water District. Its width ranges from 10 to 30 feet and it is approximately 48 miles long. Flow in the canal varies from 220 to 350 cubic feet per second. Water from the canal services both domestic and industrial users (Rocha 1988).

3.11.3 GROUNDWATER

Groundwater data within Contra Costa County are sparse, primarily because most of the water needs are met by surface waters. The USGS, however, maintains groundwater level records for two wells in the county. These wells are located in the Pittsburg Plain and in Clayton Valley. The Pittsburg Plain well water level ranges between 18 and 28 feet, whereas the Clayton Valley ranges in depth between 19 and 32 feet (USGS 1984).

Water quality data for this area are also sparse. A study of the groundwater in the Marsh Creek drainage (east of the study area) indicated that the groundwater was low in sulfates, high in chlorides, with a moderate to high concentration of total suspended solids. Because the surface water supplies the majority of the water needs in the study area, groundwater usage is limited to individual residences.

3.11.4 FLOODPLAINS

North of the study area there are several wetlands and floodplains. These areas are located primarily along the Suisun Bay and San Joaquin River. FEMA maps were used to identify areas of 100-year floodplain (Zone A classification) that may be encroached by the alignment alternatives. Zone A is the level at which FEMA and local requirements apply. Generalized locations of the potential ecroachments on Zone A areas have ben identified, and are shown on Exhibit 3.11-2. Base flood elevations and flood hazard factors have not been determined for portions of these Zone A areas. The three potential areas of encroachment are as follows:

- Near Clayton Valley Drain in Concord on Port Chicago Highway south of Olivera Way.

- Small strips along the north and south abutments of Anitoch Higway in Pittsburg.

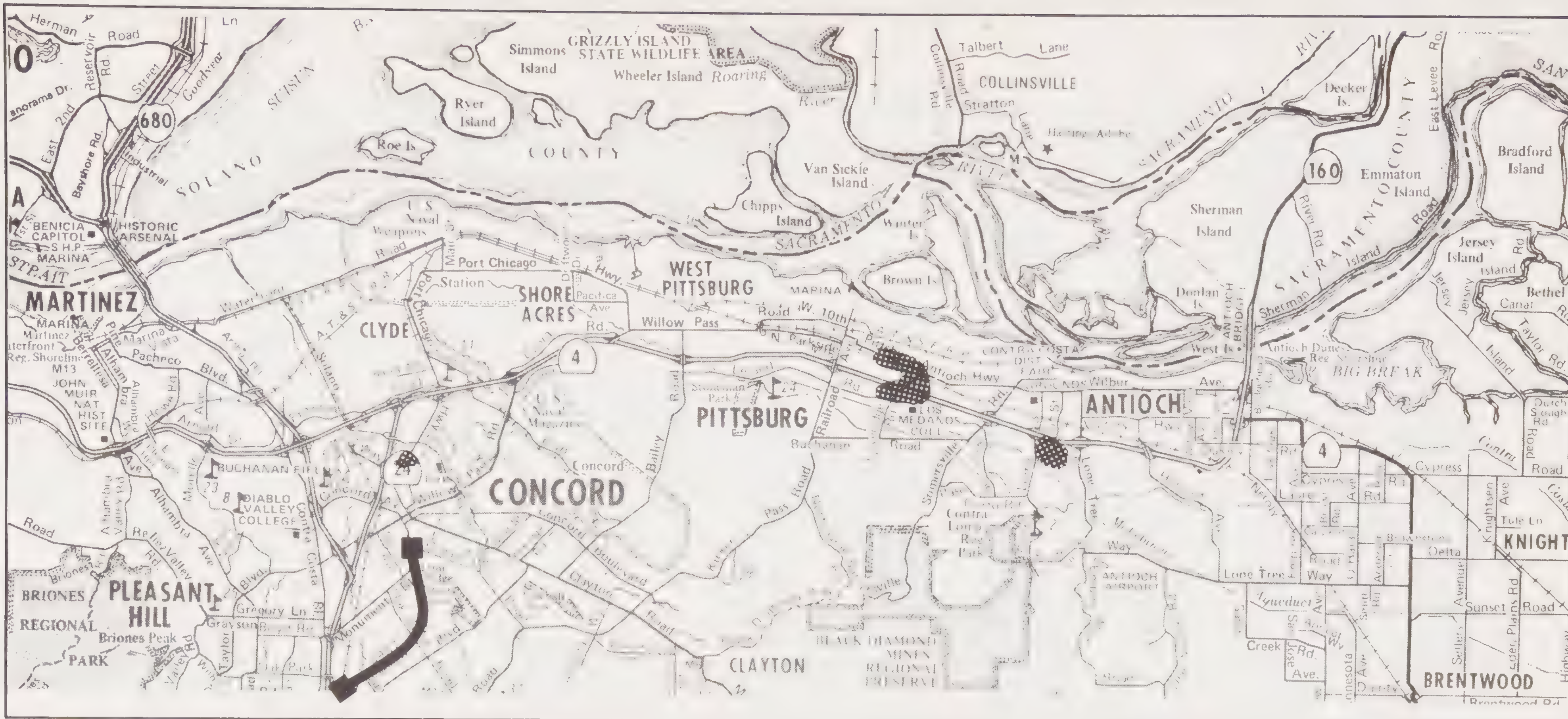
- An area south of State Route 4 in Antioch between Contra Loma Stret and G Street. A small extension of this area lies just north of State Route 4 west of Contra Loma Street.

Just east of Pittsburg, the alignment also crosses the Zone C area which is considered an area of minimal flooding. These floodplains are important wildlife habitat and are discussed in detail in Section 3.10. Presently, there are no proposed flood control projects planned for this area.

3.12 NOISE AND VIBRATION

The Pittsburg-Antioch Corridor passes through four different suburban communities as well as currently undeveloped and developed land in unincorporated Contra Costa County. The impact of the existing and future noise environment on the local inhabitants has been the subject of many studies conducted for new building projects within the communities in the corridor. In addition, noise studies have been performed for the various noise elements which are contained in the respective general plans for the cities of Antioch, Concord, and Pittsburg, and Contra Costa County. These studies demonstrate a concern, on the part of the local governmental agencies, for reducing the impact of noise on the communities they serve.

The problem of ground-borne vibration within a suburban setting is not one that most communities face. Sources of vibration in most communities are due to surface traffic (e.g., trucks, buses) and occasionally large mechanical equipment. Because of the nature of ground-borne vibration, the extent that the community is affected is much less than for airborne noise. Except in rare instances, the levels of existing ground-borne vibration transmitted to adjacent buildings are low enough to be imperceptible. Not unexpectedly, there are no publicly available studies of ambient ground-borne vibration known to exist for communities within the corridor.



Source: Federal Emergency Management Agency Flood Insurance Maps

Legend

100 YEAR FLOODPLAIN

100-Year Floodplain Map

Pittsburg-Antioch Corridor

AA/DEIR

North

0 1.5 3 MILES

BART

Exhibit 3.11-2

To supplement the noise data contained in past studies with data specific to the alternative alignments, and to establish a baseline of representative ambient community vibration data, additional measurements were conducted for the current impact analysis. Ambient noise and vibration measurements were made outside representative buildings and in representative areas along the proposed alignments to provide data on typical existing ambient levels. The data are used to classify the current community noise and vibration environments. Determination of the appropriate levels of acceptable community noise and vibration that would be emitted by new transit facilities proposed for the corridor are based in part on this characterization.

Eleven new measurement sites were chosen to further characterize the ambient noise and vibration levels within the corridor. In addition to these data there are relevant noise data from other sources for 14 locations, giving a total of 25 noise data locations within the corridor. Table 3.12-1 and Exhibit 3.12-1 indicate the location of the new noise and vibration measurements. Full details of the locations of all the noise monitoring sites and details concerning the new measurements are contained in the Pittsburg-Antioch Corridor Technical Report on Noise and Vibration by Wilson-Ihrig Associates (Appendix D of this AA/EIR).

"Spot check," or short term noise and vibration measurements were made at 10 of the 11 new locations, and 24-hour ("long term") noise measurements were made at 6 of the 11 sites in order to obtain a complete statistical representation of the existing daily noise environment. The short-term measurements were made over a 10-minute period during four characteristic periods of the day: daytime, 10 a.m. to 2 a.m.; rush hour, 4:30 p.m. to 6:30 p.m.; evening, 7 p.m. to 10 p.m.; and night, 11 p.m. to 2 a.m. No measurements were made during morning rush hour because noise levels are essentially the same as during evening rush hour.

3.12.1 EXISTING NOISE ENVIRONMENT

The principal source of noise within the corridor is motor vehicles, which is typical for a suburban environment. This applies to all portions of the various alternative alignments. All of the alternative alignments follow an existing major or secondary transportation route. Consequently, the communities directly adjacent to the alternative alignments are currently exposed to relatively high levels of noise.

Traffic volumes for all of the highways and arterials in the corridor are projected to increase significantly by the year 2000 due to a substantial population growth in the region. The volume of traffic on State Route 4 is expected to double by that time. As other studies have shown, the noise levels in the community adjacent to these transportation routes are expected to increase noticeably.

Beginning at the existing Concord BART Station, the proposed rail alignments would extend northward on aerial structures passing through a mixed commercial and residential community and then to the median of Port Chicago Highway before making a transition to a predominantly at-grade alignment on the east side of the highway with approximately 1.75 miles of primarily residential community on both sides. Within the first 2 miles of the route there are also churches, schools, and a hospital that would be affected.

TABLE 3.12-1

LOCATION OF AMBIENT NOISE AND VIBRATION MEASUREMENT SITES

Location Number[a]	Site Description
1[b]	Sidewalk on Bacon Street in Concord and near Mount Diablo Hospital and west of Port Chicago Highway.
2	Sidewalk in front of 3165 Claudia Drive in Concord.
3[b]	At end of Esperanza Drive in Concord and east of Port Chicago Highway.
4[b]	Sidewalk on Willow Pass Road in West Pittsburg and near intersection with Alberts Avenue.
5[b]	Sidewalk on Frontage Road in Pittsburg near intersection with Chelsa Way and near State Route 4.
6	Sidewalk on Carpino Avenue in Pittsburg and in front of St. Mark Missionary Baptist Church.
7	In parking lot of apartments at 2201 San Jose Drive in Antioch and near State Route 4.
8[b]	Sidewalk on G Street, near intersection with Drake Street in Antioch.
9	Sidewalk on Lincoln Lane near intersection with Tregallas Road in Antioch.
10	Sidewalk in front of 2832 Patricia Avenue near intersection with Shaddick Drive in Antioch.
11[b]	Sidewalk on Gehinger Drive near intersection with Laurence Court in Concord.

[a] Refer to Exhibit 3.12-1

[b] 24-hour noise survey site

Legend

(1) MEASUREMENT SITE NUMBER

Location of Ambient Noise and Vibration Measurement Sites
Pittsburg–Antioch Corridor AA/DEIR

North

0 1.5 3 MILES

BART

Exhibit 3.12–1

Both the LRT and BART alternatives join State Route 4 at its connection with Port Chicago Highway. Most of the rail alternatives extend along the rest of the alignment in the median of State Route 4 through West Pittsburg, Pittsburg, and Antioch, depending on the terminal point of the alternative. The community along State Route 4 is largely residential, with intermittent commercial and industrial areas. There are also several schools, churches and a major medical center adjacent to this alignment. The high traffic volume and amount of heavy truck traffic along this route make State Route 4 a dominant noise source for most of the community within the corridor.

The LRT alignment along the SPTC railroad (Alternative 5) would pass through both residential and industrial areas along this route. In the recent past this railroad alignment has been exposed to heavy freight traffic and high noise levels. Currently, the rail traffic is minimal and the present noise levels are not as high as might be expected for an existing major rail corridor.

A buyout of the SPTC by the Denver and Rio Grande Western Railroad is currently pending before the Interstate Commerce Commission. Should the buyout occur there may well be a return to increased rail traffic with corresponding higher noise levels along the SPTC right-of-way. There has been much concern within the potentially affected communities concerning train noise. Given the uncertain status of the railroad buyout situation, this segment of Alternative 5 has the greatest possibility of all the alternatives for a substantial change in the future ambient noise environment.

The spot check noise measurements (Exhibit 3.12-1) were found to agree closely with the 24-hour noise surveys where both were made at the same location. For this reason the short-term measurements were used to estimate the 24-hour noise exposure levels (e.g., Ldn) and long term noise statistical data at other locations where only short term measurements were made.

There are three single-number descriptors which represent the cumulative noise exposure environment of a particular location over a 24-hour time period. These are the Leq, Ldn, and CNEL, and are used by local, state, and federal agencies to determine noise compatibility. The Leq, Energy Equivalent Level, is a time-weighted energy average. An Leq value averages all of the loud and quiet sound levels occurring over a measurement period into an equivalent continuous sound level value. The Leq is considered a useful measure of an area's typical noise exposure. The Ldn (Day/Night Average Level) and CNEL (Community Noise Equivalent Level) are extensions of the Leq. They place greater emphasis on the time of day. To account for noise-sensitivity during quiet periods of the day, the Ldn is weighted 10 dB between 10 p.m. and 7 a.m. while the CNEL is weighted an additional 5 dB between 7 p.m. and 10 p.m. All sound measurements are A-weighted, presented in dBA, because the A-weighted sound level shows good correlation with the subjective response of people and communities with measured sound levels. The Ldn and CNEL seldom vary more than 1 dB and are essentially equal measures. Exact definitions are contained in the glossary of the Pittsburg-Antioch Corridor Technical Report on Noise and Vibration (see Appendix D).

Near the Concord BART station on Concord Avenue and Clayton Road, the downtown commercial community is exposed to 67 to 69 dBA Ldn. Along Port Chicago Highway the immediate residential community (first row of houses) is presently exposed to 64 to 66 dBA Ldn. The northern end of Port Chicago Highway tends to have slightly higher noise levels, due to more traffic and higher vehicle speeds. Within the residential area to the east of Port Chicago Highway, at distances of 150 to 200 feet from the highway, the additional distance and shielding of the first row of houses results in a 55 to 57 dBA Ldn.

At a distance of 150 feet from State Route 4, the residential and occasional commercial community is currently exposed to highway noise of 67 to 69 dBA Ldn. In Antioch, overlooking State Route 4, the residential community, at distances of 800 to 1,000 feet, is exposed to 56 to 58 dBA Ldn. Although the traffic volume on State Route 4 increases on the western end, the difference is not significant enough to noticeably raise noise levels.

At a distance of 30 feet from Willow Pass Road, and east of Bailey Road, the residences and stores are now exposed to 69 to 72 dBA Ldn. This is due to the large amount of heavy truck traffic that services the industrial areas in West Pittsburg and Pittsburg. While these values represent levels at the residences closest to the road, noise farther from the road is still relatively high.

The community along the SPTC right-of-way in Pittsburg is exposed to higher levels of train noise in the western portion of the alignment where it is near the Atchison, Topeka and Santa Fe (AT&SF) tracks. According to measurements by others (Saurenman, Towers, and Hanson 1986) in Pittsburg and at a distance of 75 feet from the SPTC tracks, the exposure is 62 dBA Ldn, whereas at a distance of 75 feet from the tracks in Antioch the measured Ldn is 58 dBA. For comparison the noise exposure at 75 feet from the AT&SF rail line in Pittsburg is 70 dBA Ldn, which indicates the effect of more freight traffic.

Alternative 3 (HOV to Antioch) follows a different route initially until it meets up with the other alignments at Port Chicago Highway and State Route 4 in the northern part of Concord. The first part of this route is west through primarily commercial areas of Concord on heavily traveled city streets to State Route 242.

Along the east side of State Route 242, there are residences in Concord at approximately 125 to 150 feet from the median of the highway. There are no recent measurements for this part of the corridor, but measurements in 1978 indicate a 60 to 65 dBA Ldn at 200 feet from the highway. It is reasonable to expect that current noise exposure is now in the range of 68 to 70 dBA Ldn at 150 feet from this highway.

3.12.2 EXISTING VIBRATION ENVIRONMENT

Existing exterior vibration sources within the corridor include automobiles, trucks, buses, railroad trains, and heavy industrial equipment. The vibration level data were taken at the same time and place as the short-term sound level data and were analyzed to obtain a single-number ("overall") unweighted velocity level (re: 1 micro in/sec). Based on studies performed directly relating to ground-borne vibration from rail transit systems, vibration velocity levels below about 69 dB are normally

imperceptible to the average person. In general, locations with the highest noise levels also have the highest vibration levels.

Vibration levels along Port Chicago Highway are slightly lower with an L1 range of 38 to 57 dB (at a distance of 80 to 100 feet) during the course of the day. This reflects the lack of heavy truck traffic, although there are presently two bus lines running on the highway. Within the residential community adjacent to Port Chicago Highway the vibration levels are even lower.

Because of the relative lack of trains using the SPTC tracks, no measurements were made of ambient noise or vibration from freight trains on the tracks in the corridor. However, based on measurements made on other projects, in particular one set of measurements made adjacent to the AT&SF tracks in nearby Oakley, the overall vibration velocity levels were 79 dB for locomotives at 75 feet from the tracks and 75 dB for freight cars at the same distance. Given the proximity of the measurement location for these data and other supporting data at similar locations in the San Francisco Bay area, similar vibration levels are to be expected for the SPTC alignment in the corridor. For the residential community in Antioch, which is within 75 to 100 feet of the SPTC tracks, the vibration from freight trains should be clearly perceptible under existing conditions.

The L1 values measured in the current study never reached and were considerably below 69 dB at all of the specified measurement locations. The vibration velocity level exceeded 1 percent of the time (or "L1") represents occasional maximum or "peak" vibration level. The L1 (meaning for approximately 6 seconds out of each 10 minutes) vibration levels near State Route 4 (at a distance of 150 feet) and Willow Pass Road (at a distance of 30 feet) range from 49 to 60 dB during the day. The higher vibration level corresponds to peak hour traffic. In general, although imperceptible, these are relatively high levels of community vibration and reflect the presence of heavy truck traffic along these routes. However, the vibration levels are typical of commercial and residential areas near heavily traveled streets and comparable to levels in other suburban areas of larger cities (e.g., San Francisco).

3.12.3 NOISE AND VIBRATION CRITERIA AND DESIGN STANDARDS

Since noise and vibration by operation of transit vehicles and associated ancillary facilities can cause significant environmental impacts, there has been legislative action--at the federal, state, and local levels--which has produced regulations that may affect the design and operational requirements of the transit facilities for the Pittsburg-Antioch Corridor project. The criteria require control of airborne and ground-borne noise and vibration from transit train operations and from transit ancillary areas and facilities. The criteria specify quantitative limits for noise emissions and establish criteria for determining compliance with relevant standards. The detailed descriptions and explanations of specific noise and vibration standards are contained in the Pittsburg-Antioch Corridor Technical Report on Noise and Vibration (see Appendix D). The salient features are discussed below.

Federal Guidelines

No federal agencies have produced regulations which directly apply to rapid rail transit noise. The U.S. Department of Transportation (DOT) and the UMTA of DOT have an interest in this area in the form of review of environmental impact statements and review of design features to assure compliance with the environmental impact statement requirements and standard industry practices. UMTA has general guidelines for evaluating the significance of noise impacts contained in "Guidelines for Preparing Environmental Assessments," UMTA C5620.1, where federal aid is being used for construction of fixed-guideway facilities. The Environmental Protection Agency (EPA) has adopted regulations which affect construction equipment noise emission.

American Public Transit Association (APTA) Guidelines

APTA works very closely with transit-related government agencies, as well as local transit operators, in developing standards of performance. In the case of transit operations, the pertinent noise and vibration criteria are generally based on the APTA document "Guidelines for Design of Rapid Transit Facilities," usually referred to a the "APTA Guidelines" (APTA 1979). However, APTA guidelines do not include standards regarding construction noise and vibration.

Local Guidelines

The State of California has enacted a number of laws intended to control noise. None of these laws directly affect the Pittsburg-Antioch Corridor. The California Administrative Code, Title 24, does indirectly establish a noise exposure limit standard for airborne noise from rail transit vehicle operation.

The cities of Concord, Pittsburg, and Antioch and Contra Costa County have complied with the requirements of the California Government Code Section 65302(g) by adopting a noise element to their general plan. These noise elements, some of which are currently under revision, contain specific guidelines relevant to the Pittsburg-Antioch Corridor. The purpose of the noise criteria in the noise elements is to assist in developing compatible land use for new building projects and consequently do not apply specifically to the control of noise from transit vehicle operation during revenue service. However, the criteria can be considered to be community goals that are an indication of a particular community's opinion concerning noise impact.

As of the date of this study, of all the governmental bodies for the potentially affected communities, only the City of Pittsburg has enacted a specific Noise Control Ordinance. There are no numerical levels specified, instead only qualitative criteria relating to "public nuisance" or disturbing the peace. The Pittsburg Ordinance does contain limits on the time of day for operation of heavy construction equipment (e.g., pile drivers). Of the other communities in the corridor, the general approach to noise complaints from citizens are also handled on a basis of nuisance. Therefore, there are no specific local ordinances which set numerical criteria for maximum noise emission levels.

Transit Industry Practices

Transit industry practices generally follow the noise and vibration goals as outlined in APTA's "Guidelines for Design of Rapid Transit Facilities." This includes all of the newer system facilities and equipment recently designed and built or currently under construction in Washington, D.C., Atlanta, Los Angeles, Baltimore, and Buffalo. Specifications for the rail projects built in these cities can be used as the starting point for developing appropriate construction noise and vibration criteria for the LRT and BART Alternatives. The construction noise and vibration criteria are generally included directly in the contracts between the building contractor and the transit agency.

FHWA Procedures

FHWA has established procedures for abatement of highway traffic noise, where federal aid is being used for construction of a new highway or "significant" relocation of an existing highway. The procedures include prediction of traffic noise from highway vehicles and criteria for determining impact based on type of adjacent land-use (activity). The noise criteria are only relevant to motor vehicles under free-flowing traffic conditions and not rail traffic. Where criteria are exceeded, noise abatement measures are to be determined and benefits from reduced impact are to be weighed with costs of the abatement measures.

3.13 AIR QUALITY

This section provides background information on the meteorology, existing air quality, status of regulatory compliance, and location of sensitive receptors in the Pittsburg-Antioch Corridor.

3.13.1 METEOROLOGY

The climate of the San Francisco Bay Area which includes Contra Costa County is affected by the Pacific Ocean, the San Francisco Bay, and local topography. The climate is characterized by mild temperatures and winter precipitation. For example, the mean monthly average temperatures in Walnut Creek range from 45°F in January to 70.6°F in July. Annual precipitation is normally about 19.9 inches in Walnut Creek. Approximately 95 percent of the precipitation occurs during the months of October through April.

The distribution of wind direction and wind speed is depicted in Exhibit 3.13-1 for the Pittsburg meteorological monitoring station, which is typical of the study area. The predominant wind direction is from the southwest (about 40 percent of the time), which corresponds to a wind flow from the San Francisco Bay along the Sacramento River Valley. Northeasterly and easterly winds are rare with a frequency of less than 10 percent. The wind speed is less than 7 mph (3.1 meters per second) more than about 70 percent of the time for all directions except for westerly and south-westerly winds. For these two directions, the wind speed exceeds 7 mph (3.1 meters per second) 40 to 60 percent of the time. The wind speed rarely exceeds 18 mph (8 meters per second).

The wind roses for the Concord and Pittsburg monitoring stations are compared in Appendix E. They show great similarities, which suggest that the wind flow in the corridor is spatially relatively homogeneous except for microscale local effects.

3.13.2 RELEVANT POLLUTANTS

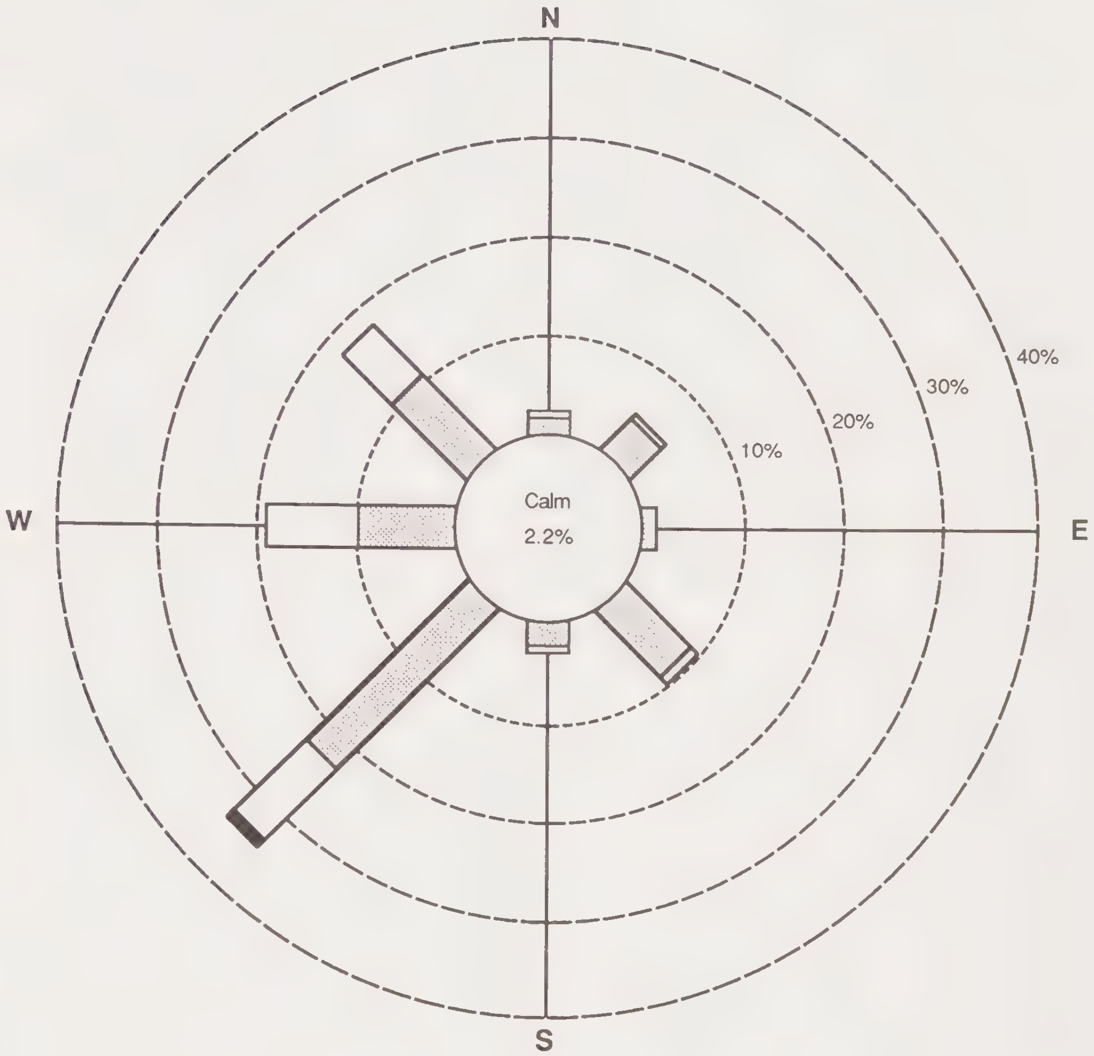
Atmospheric pollutants that are relevant to the Pittsburg-Antioch Corridor Alternatives Analysis are those that result primarily from mobile source emissions (e.g., automobiles, trucks, buses, etc.). Existing conditions associated with each of the relevant pollutants are discussed.

Relevant federal and State of California ambient air quality standards are presented in Table 3.13-1. It should be noted that the state standards are more stringent than the federal standards. Atmospheric pollutants may be directly emitted into the atmosphere (primary pollutants) or may be formed in the atmosphere (secondary pollutants) through chemical reactions of precursors. Primary pollutants emitted from mobile sources include carbon monoxide (CO), nitrogen oxides (NO and NO_2), sulfur dioxide (SO_2), reactive hydrocarbons (RHC), particulate matter (PM), and lead (Pb). Federal and state regulations exist for CO, NO_2, SO_2, particulate matter less than 10 micrometers in diameter (PM-10), and Pb. Secondary pollutants that result from the reactions of precursors emitted from mobile sources include ozone (O_3), NO_2, and PM-10. Ozone results from the reactions of NO, NO_2, and RHC in the presence of sunlight. NO_2 is directly emitted from combustion sources and is also produced from the atmospheric oxidation of NO. Particulates are directly emitted in the atmosphere but are also formed as condensible species through the oxidation of SO_2, NO_2, and RHC.

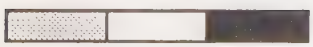
3.13.3 REGIONAL COMPLIANCE

The maximum ambient pollutant concentrations measured at the three air quality monitoring sites in the corridor are presented in Appendix E. These sites are Bechtel Island Road, Concord, and Pittsburg. It appears from these data that the corridor is in attainment of the air quality standards for CO, NO_2, SO_2, and Pb. Concentrations of CO, NO_2, and SO_2 do not show any particular temporal trend. Lead concentrations decreased between 1984 and 1986 which may be due to the decrease in the use of leaded gasoline in California. The corridor is not in attainment of the federal and state O_3 standards and of the 24-hour average state PM-10 standard; it is in attainment of the federal and annual average state PM-10 standards.

The corridor is part of the San Francisco Bay Area air basin. In addition to the nonattainment cases previously noted (i.e., O_3 federal and state standards and PM-10 state 24-hour average standard), the Bay Area air basin is in nonattainment of the CO federal and state air quality standards and PM-10 state annual average standard (Bay Area Air Quality Management District). San Jose in the south Bay Area presents the most serious CO problem. With respect to the recently promulgated (31 July 1987) PM-10 Federal standards, the Bay Area is classified as a Group II area. Group I areas are not expected to attain the PM-10 federal standards and must produce a PM-10 State Implementation Plan (SIP) by 30 April 1988. Group II areas need only to prepare a committed State Implementation Plan by that date; if monitoring data show nonattainment of the PM-10 standards, then the SIP control measures will have to be implemented.



Source: Bay Area Air Quality Management District, San Francisco, CA



Annual Wind Rose For The Pittsburg Monitoring Station

Pittsburg-Antioch Corridor AA/DEIR

North

NO SCALE

BART

Exhibit 3.13-1

TABLE 3.13-1

AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Time	National Standards		California Standards
		Primary	Secondary	
Carbon Monoxide	8 Hour Average	10 mg/m^3 (9 ppm) (a)	Same As Primary	10 mg/m^3 (9 ppm) (b)
	1 Hour Average	40 mg/m^3 (35 ppm) (a)	Same As Primary	23 mg/m^3 (20 ppm) (b)
Ozone	1 Hour Average	235 ug/m^3 (0.12 ppm) (c)	Same As Primary	200 ug/m^3 (0.10 ppm) (d, e)
Nitrogen Dioxide	Annual Average	100 ug/m^3 (0.05 ppm) (b)	Same As Primary	- -
	1 Hour Average	- -	- -	470 ug/m^3 (0.25 ppm) (d)
Sulfur Dioxide	Annual Average	80 ug/m^3 (0.03 ppm) (b)	- -	- -
	24 Hour Average	365 ug/m^3 (0.14 ppm) (a)	- -	131 ug/m^3 (0.05 ppm) (d)
	3 Hour Average	- -	1300 ug/m^3 (0.5 ppm) (a)	- -
	1 Hour Average	- -	- -	655 ug/m^3 (0.25 ppm) (b)
Particulate Matter (PM-10)	Annual Average	50 ug/m^3	Same as Primary	30 ug/m^3 (b, f)
	24 Hour Average	150 ug/m^3 (a)	Same as Primary	50 ug/m^3 (b)
Lead	Calendar Quarter Average	1.5 ug/m^3 (a)	Same as Primary	- -
	30 Day Average	- -	- -	1.5 ug/m^3 (d)

a Not to be exceeded more than once a year.
b Not to be exceeded.
c Not to be exceeded more than three times over a 3-year period.
d Not to be equaled or exceeded.
e The state standard pertains to oxidants measured as ozone.
f Annual geometric average; other annual average values are arithmetic averages.

Source: Bay Area Air Quality Management District 1987.

The O_3 and CO concentration trends over the last 10 years show a significant decrease of air pollution levels which result primarily from decreases in hydrocarbon emissions (precursors of O_3) and CO emissions (ABAG 1987). The 1982 SIP prepared by the ABAG, the Bay Area Air Quality Management District (BAAQMD), and the MTC was approved by the EPA in 1983. This SIP presents the emission control measures that will be implemented in the Bay Area to attain the O_3 and CO federal standards. The major emission control measures include 23 control measures for stationary sources of hydrocarbon emissions and the implementation of an inspection/maintenance (I/M) program for automobile exhausts. The I/M program is the most effective control measure for reducing O_3 and CO levels in the Bay Area. Further improvements of the I/M program are planned (ABAG 1987). Several transportation and development control measures were also included in the 1982 SIP (e.g., car pooling, van pooling, transit improvements, and HOV expressway lanes). However, these measures have little effect on total emission reductions compared to other measures such as the I/M program (ABAG 1987). Additional emission control measures may be required to bring the Bay Area in attainment of the O_3 and CO federal standards. No specific control measures related to transportation systems are planned at the moment (ABAG 1987).

3.13.4 ESTIMATED AIR QUALITY BASELINE

The baseline air quality for the year 2000 can be estimated based on projections of changes in traffic flow. These projections suggest, for the No-Build Alternative, an increase in traffic of approximately 60 percent. This result implies that the CO ambient levels should remain below the federal and state standards at the Pittsburg and Bechtel Island monitoring stations but might exceed the standard at the Concord monitoring station.

3.13.5 IDENTIFICATION OF SENSITIVE SITES

Sites that are defined as sensitive with respect to air quality are characterized by populations that are particularly sensitive to the adverse health effects of air pollutants. Such sites include, for example, hospitals, homes, and centers for the elderly, and primary and secondary schools.

The sites that were selected as potentially sensitive to air pollution include the following:

- Mount Diablo Hospital (City of Concord)
- Bel Air School (West Pittsburg)
- Pittsburg High School (City of Pittsburg)
- Los Medanos School (City of Pittsburg)
- Parkside School (City of Pittsburg)
- Senior Citizen's Center (City of Pittsburg)
- Antioch High School (City of Antioch)
- Antioch Junior High School (City of Antioch)
- Bidwell School (City of Antioch)
- Kaiser Medical Center (Antioch)

Residential neighborhoods adjacent to the corridor are also considered to be sensitive receptors related to air quality. Residential areas are located next to each of the potential alternative alignment (Concord Avenue/State Route 242, State Route 4, and the Southern Pacific Railroad).

SECTION 4
TRANSPORTATION IMPACTS

4.1 INTRODUCTION

This section presents the results of the assessment of transportation impacts associated with the alternatives being considered for the Pittsburg/Antioch Corridor. The following subjects are discussed in this section, even though not all of these are considered impacts:

- Transit capacity and supply
- Transit and highway traveltimes
- Transit ridership
- Transit and high-occupancy vehicle guideway trips in the corridor
- Numbers of persons using rail stations and bus park-and-ride lots in the corridor
- Vehicle volumes on State Route 4 and operational implications
- Traffic volumes at intersections near rail stations and park-and-ride lots
- Parking demand compared to parking supply at rail stations and park and ride lots
- Savings in travel times

The main transportation impacts associated with the corridor alternatives would be increases in traffic at end-of-line stations and, for some alternatives, parking demand projected to be in excess of parking supply. These impacts would be caused by the ridership forecast for the alternatives and by the changes in the mode of access forecast for persons traveling to the Concord BART station and the other rail stations or bus park-and-ride lots included in each alternative.

The key results of the transportation evaluation are presented primarily by comparing the guideway alternatives (HOV, LRT, and BART) with the TSM alternatives for the conditions projected to occur in the year 2000. This format is used to corresponding to guidelines established by the Urban Mass Transportation Administration (UMTA) for Federally- sponsored Alternatives Analysis. To provide a greater understanding of how the alternatives would change the supply of or demand for transportation in the future (year 2000), the supply and demand characteristics that existed in the corridor in 1987 are also presented.

4.2 TRANSIT SERVICE CHARACTERISTICS

The transit service characteristics of the alternatives which would directly affect potential patronage, operating and maintenance costs, or capital costs, are described in Table 4.2-1.

TABLE 4.2-1

TRANSIT SERVICE LEVELS, 1987 AND THE ALTERNATIVES

	1987	YEAR 2000 ALTERNATIVES											
NUMBER OF ROUTES		1	2	3	3A	4	4A	5	6	7	7A	7B	8
BART /a/	1	1	1	1	1	1	1	1	1	1	1	1	1
LRT	-	-	-	-	-	1	1	1	-	-	-	-	1
Bart Express Bus /b/	3	1	3	6	6	1	1	1	3	1	1	1	1
Tri-Delta Transit	3	3	5	4	4	4	4	4	5	4	5	5	4
County Connection /c/	25	25	29	29	29	29	29	29	29	29	29	29	29
ROUTE DISTANCE (TWO-DIRECTIONAL MILES)													
BART	72	72	72	72	72	72	72	72	77	105	87	93	77
LRT	-	-	-	-	-	33	25	32	-	-	-	-	21
Bart Express Bus	109	53	87	196	196	36	36	36	72	36	42	36	36
Tri-Delta Transit	99	95	151	114	114	114	114	114	151	114	198	182	114
County Connection	392	398	482	482	482	482	482	482	482	482	482	482	482
PEAK-HOUR VEHICLES													
BART /d/	15	18	18	18	18	18	18	18	19	23	21	22	19
LRT /d/	-	-	-	-	-	8	7	8	-	-	-	-	6
Bart Express Bus	8	15	14	24	24	10	10	10	10	10	8	7	10
Tri-Delta Transit	8	8	31	23	23	23	23	23	31	23	37	34	23
County Connection	77	77	109	109	109	109	109	109	109	109	109	109	109
OFF-PEAK VEHICLES													
BART /d/	10	10	10	10	10	10	10	10	11	15	13	14	11
LRT /d/	-	-	-	-	-	4	3	4	-	-	-	-	3
Bart Express Bus	4	6	2	4	4	5	5	5	2	5	4	4	5
Tri-Delta Transit	5	5	14	10	10	10	10	10	14	10	15	14	10
County Connection	44	44	50	50	50	50	50	50	50	50	50	50	50

TABLE 4.2-1 (Continued)

	1987	YEAR 2000 ALTERNATIVES											
PEAK-HOUR CAPACITIES (PLACES) /e/		1	2	3	3A	4	4A	5	6	7	7A	7B	8
BART /f/	13,335	26,665	26,665	26,665	26,665	26,665	26,665	26,665	26,665	13,335/g/	13,335/g/	13,335/g/	26,665
LRT	-	-	-	-	-	2,560	2,560	2,560	-	-	-	-	2,560
Bart Express Bus	250	200	600	1,400	1,400	200	200	200	600	200	200	200	200
Tri-Delta Transit	200	200	900	700	700	700	700	700	900	700	1,100	1,100	700
County Connection	3,200	3,200	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500	4,500
WEEKDAY VEHICLE MILES (THOUSANDS)													
BART /d/	5.64	6.81	6.81	6.81	6.81	6.81	6.81	6.81	7.34	10.82	9.02	7.34	7.34
LRT /d/	-	-	-	-	-	3.20	2.68	3.28	-	-	-	-	2.51
Bart Express Bus	2.77	3.46	2.44	7.13	7.13	1.69	1.69	1.69	2.12	1.69	1.95	1.69	1.69
Tri-Delta Transit	1.38	1.50	5.33	3.79	3.79	3.79	3.81	3.81	5.32	3.79	7.07	3.81	3.81
County Connection	10.24	10.07	14.35	14.37	14.37	14.35	14.35	14.35	14.35	14.35	14.35	14.35	14.35
ANNUAL VEHICLE MILES (THOUSANDS)													
BART /d/	1,843	2,225	2,225	2,225	2,225	2,225	2,225	2,225	2,364	3,559	2,938	2,364	2,364
LRT /d/	-	-	-	-	-	1,028	789	1,055	-	-	-	-	790
Bart Express Bus	868	1,076	658	1,981	1,981	539	539	539	583	539	623	539	539
Tri-Delta Transit	352	382	1,353	962	962	962	968	968	1,353	962	1,797	1,525	968
County Connection	3,031	2,991	4,242	4,246	4,246	4,242	4,242	4,242	4,242	4,242	4,242	4,242	4,242
WEEKDAY VEHICLE HOURS (THOUSANDS)													
BART /d/	0.17	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.22	0.30	0.26	0.22	0.22
LRT /d/	-	-	-	-	-	0.08	0.07	0.08	-	-	-	-	0.06
Bart Express Bus	0.11	0.16	0.11	0.20	0.20	0.12	0.12	0.12	0.08	0.12	0.09	0.12	0.12
Tri-Delta Transit	0.11	0.10	0.33	0.24	0.24	0.24	0.24	0.24	0.33	0.24	0.37	0.24	0.24
County Connection	0.90	0.77	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09	1.09

TABLE 4.2-1 (Continued)

ANNUAL VEHICLE HOURS (THOUSANDS)	1987	YEAR 2000 ALTERNATIVES											
		1	2	3	3A	4	4A	5	6	7	7A	7B	8
BART /d/	55	67	67	67	67	67	67	67	70	98	84	91	70
LRT /d/	-	-	-	-	-	26	20	26	-	-	-	-	19
Bart Express Bus	34	49	30	58	58	37	37	37	22	37	29	37	37
Tri-Delta Transit	26	25	83	60	60	60	60	60	83	60	94	80	60
County Connection	231	230	321	321	321	321	321	321	321	321	321	321	321

/a/ Statistics presented for the Daly City - Concord (North Concord, West Pittsburg, Pittsburg or Antioch) line only.
/b/ Statistics shown for routes in the Pittsburg/Antioch Corridor only.
/c/ Statistics presented for CCCTA's entire service area.
/d/ Trains.
/e/ Place refers to the number of seated and standing passengers accomodated on each transit vehicle. Capacities shown for the peak-direction only, based on scheduled headways.
/f/ At or east of Concord station.
/g/ Assumes that east of Concord Yard 5-car trains would operate at 4.5 minute headways or 10-car trains would operate at 9 minute headways.

Sources : For BART and LRT, Memorandum from Manuel Padron and Associates to David White, Bechtel, May 11, 1988. For bus services, URAP (Route Analysie Program) outputs produced by Barton - Aschman Associates, Inc.. For 1987, Short Range Transit Plans for the operators supplemented by telephone conversations.

The following are the key service supply characteristics of the alternatives:

1. The number of routes and route-miles depends directly on the definition of the alternatives, i.e., the provision of BART, LRT, or express bus service in the corridor.

2. The numbers of peak-hour and off-peak vehicles shown are a function of route distances and headways defined for each alternative service.

3. Peak-hour capacities, on the other hand, are based on the numbers of transit vehicles needed to provide the scheduled peak-direction headways to satisfy the projected ridership. Capacities are based on the following numbers of seated and standing passengers being accommodated (places): 50 per bus, 200 per BART car with either 5 or 10-car BART trains, and 160 per LRT car with 2-car LRT trains during the peak period. Off-peak-period capacities would have the same number of seats and places per transit vehicle, with the number of cars per train changing to 5 for BART and 1 for LRT.

4. The numbers of equivalent annual days used to multiply weekday vehicle-miles and vehicle-hours to calculate annual statistics are based on the amount of service to be operated on Saturdays, Sundays and holidays compared to weekdays.

The service annualization factors are based on the descriptions of service included in each transit operator's most recent Short Range Transit Plan, and assume no change in each operator's allocation of service among weekdays, Saturdays, Sundays and holidays. Operators providing only service during weekdays are assumed to continue to not provide service on weekends, while transit operators providing service on weekends are assumed to provide the same proportion of weekday and weekend service in the future.

4.2.1 PEAK-HOUR CAPACITIES AND VEHICLES

As shown in Table 4.2-2, BART capacities, as measured east of Concord station, would change from the TSM alternative if BART service were extended east of North Concord/Martinez. All alternatives also assume the completion of BART's Capacity Expansion Program which would result in a 67 percent increase in BART peak-hour service between 1987 and 2000 on the Concord-Daly City line with a corresponding reduction in headways from 7.5 to 4.5 minutes. The operating plan for BART assumes operating 5 car trains every 4.5 minutes if BART were extended east of North Concord/Martinez and 10-car trains every 4.5 minutes if BART were extended to North Concord/Martinez. BART's capacity east of the Concord Yard (located between the Pleasant Hill and Concord stations) would be different if BART were extended east of North Concord because fewer sea would be provided east of Concord Yard. That reduction in capacity could be accomplished by splitting 10-car trains into two 5-car trains at the Pleasant Hill Station.

TABLE 4.2-2

PEAK-HOUR TRANSIT SUPPLY DIFFERENCES, 1987 AND THE ALTERNATIVES /a/

PEAK-HOUR CAPACITIES (PLACES)	1987	YEAR 2000 ALTERNATIVES 1	3	3A	4	4A	5	6	7	7A	7B	8
BART /b/	-10,665	0	0	0	0	0	0	0	-13,330 /f/	-13,330 /f/	-13,330 /f/	0
LRT	-	-	-	-	2,560	2,560	2,560	-	-	-	-	2,560
Bart Express Bus /c/	-350	-400	800	0	-400	-400	-400	0	-400	-400	-400	-400
Tri-Delta Transit	-700	-700	-200	0	-200	-200	-200	0	-200	200	200	-200
County Connection /d/	-1,300	-1,300	0	0	0	0	0	0	0	0	0	0
PEAK-HOUR VEHICLES												
BART /e/	-3	0	0	0	0	0	0	1	5	3	4	1
LRT /e/	-	-	-	-	8	7	8	-	-	-	-	6
Bart Express Bus	-6	1	10	10	-4	-4	-4	-4	-4	-6	-7	-4
Tri-Delta Transit	-23	-23	-8	-8	-8	-8	-8	0	-8	6	3	-8
County Connection	-32	-32	0	0	0	0	0	0	0	0	0	0

/a/ Differences between each Alternative and the TSM Alternative. Numbers preceded by a minus sign indicate values lower than those of the TSM Alternative.

/b/ Statistics presented for the Daly City - Concord (North Concord, West Pittsburg, Pittsburg or Antioch) line only, measured at Concord station.

/c/ Statistics shown for routes in the Pittsburg/Antioch Corridor only.

/d/ Statistics presented for CCCTA's entire service area.

/e/ Trains.

/f/ Based on assumption that east of Concord Yard 5-car trains would operate at 4.5 min headways or 10-car trains would operate at 9 minute headways.

Source : Barton - Aschman Associates ,Inc.; based on different sources for each Alternative.

The greatest numbers of peak buses would be in service with Alternative 3 and 3A the Busway/HOV Lane Alternatives. Fewer Tri-Delta Transit and BART express buses would be operated with the other alternatives than with the TSM Alternative because BART or LRT service would be provided in the Corridor. The number of County Connection buses would be unaffected by the alternatives.

The numbers of off-peak transit vehicles in service would change from the TSM Alternative, depending on whether BART, LRT or express bus service would be the main component of an alternative. Unlike the peak-hour (where projected demand was assumed to affect headways and capacities, during off-peak hours, headways would be assumed to be set by policy standards.

4.2.2 VEHICLE-MILES AND VEHICLE-HOURS

These characteristics of transit service supply would be directly affected by the number of routes in service, the lengths of the routes in service, and the hours of operation assumed for each type of service on weekdays, Saturdays, Sundays and holidays. The changes shown on Table 4.2-3 would be directly due to the definition of the alternatives (their service orientation).

All vehicle miles and hours would increase between 1987 and 2000, except for BART express buses. The most important difference between 1987 and the TSM Alternative would be caused by the assumed change in institutional classification between some BART Express and Tri-Delta Transit routes. In addition, the remaining BART Express bus routes would be shortened by operating more miles on State Route 4 and fewer miles on arterials.

4.2.3 HIGHWAY AND HOV CHARACTERISTICS

The major difference between the TSM Alternative and the other alternatives would occur between the following two groups of alternatives:

1. The Busway/HOV Lane Alternatives (3 and 3A) would include an additional lane in each direction on State Route 4 designated for use by buses and other high-occupancy vehicles during peak periods. The HOV lanes would be used as mixed-flow lanes during off-peak hours.

2. All networks but the one for the No Action Alternative were defined by MTC to include HOV lanes on I-680 between I-580 and Route 24. Although not located in the Pittsburg/Antioch Corridor, these HOV lanes would affect the differences among alternatives in roadway vehicle miles and vehicle hours traveled presented later in this report.

4.3 TRAVEL TIME DIFFERENCES

The different transit alternatives considered for the Pittsburg/Antioch Corridor would provide different travel times to persons living or working in the corridor and traveling to other parts of the region. Each traveler's choice of modes would also be affected by differences among alternatives in the dollar cost of travel and more

subjective factors, such as the comfort and convenience of the journey. Lower-income travelers, particularly those without a vehicle available for their trips, would consider travel cost as important or more important than travel time in selecting a mode of travel to use. Higher-income travelers would consider total traveltime between their point of origin and their point of destination as the most important attribute when comparing travel modes available to them.

One of the primary objectives of the transit alternatives being considered for the Pittsburg/Antioch Corridor is to provide shorter transit travel times for employed residents of the corridor traveling to major employment centers. The evaluation measure used to determine if this objective would be attained consists of comparing the traveltimes for each alternative from selected residential areas in the corridor to selected employment centers in the region. In this comparison, the total accumulation of time required to complete a journey from the traveler's origin to the traveler's destination is a function of the headway, speed, and access and egress characteristics of the seven alternative transit systems being evaluated.

The two components of total travel times from each (analysis) zone of origin to each (analysis) zone of destination are in-vehicle times and out-of-vehicle times. In-vehicle times would include all the times elapsed while riding transit vehicles. Out-of-vehicle times would include the following: the time spent driving or walking from the origin zone to the first transit boarding stop; waiting for the first transit vehicle to arrive; if transferring to a second transit vehicle, that (second) wait time; walking to the destination zone; and any time required to travel through a rail or bus terminal (from the parking lot or bus stop) to the rail or express bus loading platform. As out-of-vehicle time represents the onerous portion of the journey, that portion occurring at zero miles per hour, out-of-vehicle time is usually weighted by a factor of 2 to 3. The weighted value of out-of-vehicle time is added to in-vehicle time to represent the total transit travel time.

Differences in in-vehicle travel times among alternatives caused by differences in operating speeds of the BART, LRT, or express bus services assumed for the corridor are relatively small, so they would not be significant in the context of comparing total transit travel times. (Total transit travel time is what travelers measure and compare. In vehicle travel times between the East Antioch and Concord terminals would range from 22 minutes on BART to 24 minutes on express buses to 30 minutes on light rail transit on the Route 4 alignment. (In-vehicle travel times for light rail transit on the Southern Pacific Railroad alignment would be about 6 minutes longer because of the additional distance to be covered.) Operating speeds would be very similar for BART (45 miles per hour) and express buses (43 miles per hour, but slower for LRT trains (33 miles per hour).

TABLE 4.2-3

WEEKDAY AND ANNUAL TRANSIT SUPPLY DIFFERENCES, 1987 AND THE ALTERNATIVES /a/

	1987	YEAR 2000 ALTERNATIVES										
WEEKDAY VEHICLE MILES (THOUSANDS)		1	3	3A	4	4A	5	6	7	7A	7B	8
BART /b/,/d/	-1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.54	4.02	2.21	3.03	0.54
LRT /d/	-	-	-	-	3.20	2.68	3.28	-	-	-	-	2.51
Bart Express Bus /c/	0.34	1.03	4.69	4.69	-0.74	-0.74	-0.74	-0.32	-0.74	-0.48	-0.74	-0.74
Tri-Delta Transit	-3.94	-3.82	-1.54	-1.54	-1.54	-1.51	-1.51	-0.00	-1.54	1.75	0.68	-1.51
County Connection /e/	-4.11	-4.29	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL VEHICLE MILES (THOUSANDS)												
BART /b/,/d/	-382	0	0	0	0	0	0	139	1,335	713	996	139
LRT /d/	-	-	-	-	1,028	789	1,055	-	-	-	-	790
Bart Express Bus /c/	210	418	1,323	1,323	-119	-119	-119	-75	-119	-35	-119	-119
Tri-Delta Transit	-1,000	-971	-390	-390	-390	-384	-384	0	-390	445	173	-384
County Connection /e/	-1,211	-1,251	4	4	0	0	0	0	0	0	0	0
WEEKDAY VEHICLE HOURS (THOUSANDS)												
BART /b/,/d/	-0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.09	0.05	0.07	0.01
LRT /d/	-	-	-	-	0.08	0.07	0.08	-	-	-	-	0.06
Bart Express Bus /c/	0.00	0.05	0.10	0.10	0.01	0.01	0.01	-0.03	0.01	-0.02	0.01	0.01
Tri-Delta Transit	-0.21	-0.23	-0.09	-0.09	-0.09	-0.09	-0.09	0.00	-0.09	0.05	-0.01	-0.09
County Connection /e/	-0.19	-0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
ANNUAL VEHICLE HOURS (THOUSANDS)												
BART /b/,/d/	-12	0	0	0	0	0	0	4	31	17	24	4
LRT /d/	-	-	-	-	26	20	26	-	-	-	-	19
Bart Express Bus /c/	4	20	28	28	7	7	7	-8	7	-1	7	7
Tri-Delta Transit	-57	-58	-22	-23	-22	-23	-22	0	-22	11	-3	-23
County Connection /e/	-90	-91	0	0	0	0	0	0	0	0	0	0

/a/ Differences between each Alternative and the TSM Alternative.
/b/ Statistics presented for the Daly City - Concord (North Concord, West Pittsburg, Pittsburg or Antioch) line only.
/c/ Statistics shown for routes in the Pittsburg/Antioch Corridor only.
/d/ Trains.
/e/ Statistics presented for CCCTA's entire service area.

Sources : For BART and LRT, Memorandum from Manuel Padron and Associates to David White, Bechtel, May 11, 1988. For bus services, URAP outputs produced by Barton - Aschman Associates,Inc. For 1987, Short Range Transit Plans for the operators, supplemented by telephone conversations. Barton - Aschman associates, Inc., for all interpolations.

4.3.1 TRANSIT TRAVEL TIMES

For this analysis, total transit travel times were calculated for each alternative transit network for travel between origin zones in Brentwood, Southeast Antioch, Northwest Antioch, North Pittsburg, and North Concord and destination zones in the downtowns of Concord, Walnut Creek, Oakland, and San Francisco and the Bishop Ranch development in San Ramon. Total traveltimes for the alternatives are shown in Table 4.3-1, with differences between each alternative and the TSM Alternative shown in Table 4.3-2. The travel times shown are the shortest travel times projected for each possible choice of paths that could be available with each alternative, e.g., if driving to a park-and-ride lot and then riding an express bus were faster than walking to a local bus stop to get a particular destination the first traveltime is the one shown.

Review of Tables 4.3-1 and 4.3-2 reveals the following general conclusions about total transit travel times:

1. In almost all cases, all of the build (or guideway) alternatives would result in shorter total transit travel times than the TSM and No Action Alternatives.

2. In all cases, the BART to East Antioch Alternative would result in the shortest total transit travel times, particularly for trips to San Francisco and Oakland.

3. There would be no significant differences in total transit travel times between the LRT alignment alternatives.

Changes in total travel times would be due to changes in the two components of travel time--in vehicle and out-of-vehicle. Review of those components of total travel times used to create the ridership forecasts for this analysis indicates the following projected changes between in-vehicle and out-of-vehicle travel times:

1. In almost all cases, the build (or guideway) alternatives would result in shorter total transit travel times than the TSM and No Action Alternatives because decreases in out-of-vehicle times would greatly offset increases in in-vehicle times.

2. In all cases, the BART to East Antioch Alternative would result in the shortest total transit travel times, particularly for trips to San Francisco and Oakland. The three most significant reasons for this conclusion are that increased travel distances and times on BART would be greatly offset by (1) reductions in access time caused by having to drive fewer miles on congested streets or State Route 4 (to get to a BART station in the corridor), or (2) not having to wait for and transfer from BART express buses to BART, or (3) not having to spend as much time parking the vehicle or dropping someone off at the Concord BART station. Each of these changes would affect travelers differently based on their point of origin in the corridor and mode of access used to travel to the Concord BART Station.

TABLE 4.3-1

TOTAL TRANSIT TRAVEL TIMES (MINUTES) FOR SELECTED ORIGINS AND DESTINATIONS /a/

FROM :	ZONE		TO :	ZONE	YEAR 2000 ALTERNATIVES											
					1	2	3	3A	4	4A	5	6	7	7A	7B	8
Brentwood	(82)	-	Concord	(480)	76	70	58	62	60	62	61	76	51	64	59	62
Brentwood	(82)	-	Walnut Creek	(98)	96	91	71	78	71	74	72	84	59	73	68	71
Brentwood	(82)	-	Bishop Ranch	(84)	136	110	110	110	102	117	108	110	98	112	107	107
Brentwood	(82)	-	Oakland	(143)	118	113	92	100	93	95	94	106	81	94	90	93
Brentwood	(82)	-	San Francisco	(421)	132	126	106	113	106	109	107	120	95	108	104	106
SE. Antioch	(79)	-	Concord	(480)	62	56	44	48	48	50	49	47	39	43	41	48
SE. Antioch	(79)	-	Walnut Creek	(98)	68	68	57	61	59	62	60	56	47	51	49	59
SE. Antioch	(79)	-	Bishop Ranch	(84)	107	96	96	96	90	95	96	96	86	91	89	95
SE. Antioch	(79)	-	Oakland	(143)	89	89	78	82	81	84	82	77	69	73	71	81
SE. Antioch	(79)	-	San Francisco	(421)	103	103	92	96	94	97	95	91	83	87	86	94
NW. Antioch	(76)	-	Concord	(480)	58	53	44	47	43	45	43	45	35	42	40	45
NW. Antioch	(76)	-	Walnut Creek	(98)	65	65	57	60	55	56	55	54	44	51	49	54
NW. Antioch	(76)	-	Bishop Ranch	(84)	104	82	82	82	86	82	94	82	83	82	83	93
NW. Antioch	(76)	-	Oakland	(143)	86	86	78	81	76	78	76	75	65	72	70	75
NW. Antioch	(76)	-	San Francisco	(421)	100	100	92	95	90	91	90	89	79	86	84	89
N. Pittsburg	(565)	-	Concord	(480)	46	43	37	39	37	46	36	39	30	37	35	39
N. Pittsburg	(565)	-	Walnut Creek	(98)	59	59	50	53	49	48	48	48	38	43	41	47
N. Pittsburg	(565)	-	Bishop Ranch	(84)	98	83	89	87	80	88	91	83	77	83	81	90
N. Pittsburg	(565)	-	Oakland	(143)	80	80	71	74	70	70	69	69	60	65	63	68
N. Pittsburg	(565)	-	San Francisco	(421)	94	94	85	88	84	84	83	83	73	78	76	82
N. Concord	(575)	-	Concord	(480)	24	19	24	22	24	25	25	19	18	20	19	19
N. Concord	(575)	-	Walnut Creek	(98)	39	39	39	39	35	40	36	28	27	28	28	35
N. Concord	(575)	-	Bishop Ranch	(84)	78	78	78	78	75	80	76	67	66	68	67	75
N. Concord	(575)	-	Oakland	(143)	60	60	60	60	57	62	58	49	48	50	49	57
N. Concord	(575)	-	San Francisco	(421)	74	74	74	74	71	76	72	63	62	63	63	71

/a/ These times include all door-to-door times, including in-vehicle travel times, zonal access and egress times, first wait and transfer times. Times are based on the representation of AM peak-period operating speeds and levels of service.

Source : Pittsburg/Antioch Corridor AA/DEIS - Revised Service Level Analysis Data (Attachment to June 23, 1987 memorandum from Chuck Purvis, MTC).
Barton - Aschman Associates, Inc. for all interpolations.

TABLE 4.3-2

TOTAL TRANSIT TRAVEL TIMES (MINUTES) FOR SELECTED ORIGINS AND DESTINATIONS, DIFFERENCES BETWEEN EACH ALTERNATIVE AND THE TSM ALTERNATIVE /a/

YEAR 2000
ALTERNATIVES

FROM :	ZONE		TO :	ZONE	1	3	3A	4	4A	5	6	7	7A	7B	8
Brentwood	(82)	-	Concord	(480)	6	-12	-8	-10	-8	-9	6	-19	-6	-11	-8
Brentwood	(82)	-	Walnut Creek	(98)	5	-20	-13	-20	-17	-19	-7	-32	-18	-23	-18
Brentwood	(82)	-	Bishop Ranch	(84)	26	0	0	-8	7	-2	0	-12	2	-3	6
Brentwood	(82)	-	Oakland	(143)	5	-21	-13	-20	-18	-19	-7	-32	-19	-23	-19
Brentwood	(82)	-	San Francisco	(421)	6	-20	-13	-20	-17	-19	-6	-31	-18	-22	-18
SE. Antioch	(79)	-	Concord	(480)	6	-12	-8	-8	-6	-7	-9	-17	-13	-15	-8
SE. Antioch	(79)	-	Walnut Creek	(98)	0	-11	-7	-9	-6	-8	-12	-21	-17	-19	-7
SE. Antioch	(79)	-	Bishop Ranch	(84)	11	0	0	-6	-1	0	0	-10	-5	-7	-2
SE. Antioch	(79)	-	Oakland	(143)	0	-11	-7	-8	-5	-7	-12	-20	-16	-18	-6
SE. Antioch	(79)	-	San Francisco	(421)	0	-11	-7	-9	-6	-8	-12	-20	-16	-17	-7
NW. Antioch	(76)	-	Concord	(480)	5	-9	-6	-10	-8	-10	-8	-18	-11	-13	-8
NW. Antioch	(76)	-	Walnut Creek	(98)	0	-8	-5	-10	-9	-10	-11	-21	-14	-16	-10
NW. Antioch	(76)	-	Bishop Ranch	(84)	22	0	0	4	0	12	0	1	0	1	-1
NW. Antioch	(76)	-	Oakland	(143)	0	-8	-5	-10	-8	-10	-11	-21	-14	-16	-9
NW. Antioch	(76)	-	San Francisco	(421)	0	-8	-5	-10	-9	-10	-11	-21	-14	-16	-10
N. Pittsburg	(565)	-	Concord	(480)	3	-6	-4	-6	3	-7	-4	-13	-6	-8	-4
N. Pittsburg	(565)	-	Walnut Creek	(98)	0	-9	-6	-10	-11	-11	-11	-21	-16	-18	-12
N. Pittsburg	(565)	-	Bishop Ranch	(84)	15	6	4	-3	5	8	0	-6	0	-2	4
N. Pittsburg	(565)	-	Oakland	(143)	0	-9	-6	-10	-10	-11	-11	-20	-15	-17	-11
N. Pittsburg	(565)	-	San Francisco	(421)	0	-9	-6	-10	-10	-11	-11	-21	-16	-18	-11
N. Concord	(575)	-	Concord	(480)	5	5	3	5	6	6	0	-1	1	0	0
N. Concord	(575)	-	Walnut Creek	(98)	0	0	0	-4	1	-3	-11	-12	-11	-11	0
N. Concord	(575)	-	Bishop Ranch	(84)	0	0	0	-3	2	-2	-11	-12	-10	-11	1
N. Concord	(575)	-	Oakland	(143)	0	0	0	-3	2	-2	-11	-12	-10	-11	1
N. Concord	(575)	-	San Francisco	(421)	0	0	0	-3	2	-2	-11	-12	-11	-11	1

/a/ These times include all door-to-door times , including in-vehicle travel times , zonal access and egress times, first wait and transfer times. Times are based on the representation of A.M peak - period operating speeds and levels of service.

Source : Barton - Aschman Associates ,Inc.; based on Pittsburg/Antioch Corridor AA/DEIS - Revised Service Level Analysis Data.
(Attachment to June 23, 1987 memorandum from Chuck Purvis, MTC).
Barton - Aschman Associates, Inc. for all interpolations.

3. There would be no significant differences in total transit travel times between the LRT alignment alternatives, because there would be no significant differences in either in-vehicle or out-of-vehicle travel times. The only noticeable differences would occur for trips destined to Bishop Ranch, where the State Route 4 alignment would provide shorter travel times than the SPTC alignment because that alignment would provide shorter in-vehicle travel distance on LRT trains to the Concord BART station, or because, in some cases, driving to the Concord BART station to ride County Connection express bus service to Bishop Ranch would be faster. (The SPTC LRT alignment requires a transfer onto Tri-Delta Transit to travel to the Bailey Road park-and-ride lot, which is served by the Tri-Delta Transit route destined to Bishop Ranch.)

4. The LRT and Busway/HOV Lane Alternatives would generally have longer travel times than the BART extension alternatives because the former would not be able to transport riders directly to their destinations, while, in some cases, the latter would. In most cases, travelers would only be able to use the LRT and express bus services defined for the Pittsburg/Antioch Corridor as shuttles to BART or County Connection services. Travelers would not be able to use the LRT or express bus routes to complete their journeys beyond downtown Concord and the BART station. The need to transfer would affect any LRT Alternatives in the Corridor, unless they were assumed to also consist of LRT extensions in Contra Costa County. Similarly the need to transfer from express buses could be eliminated and direct bus journeys provided if county-wide limited-stop or express bus service were assumed for Contra Costa County.

5. The travel times projected for the shorter alternatives would follow the same pattern as projected for their counterpart primary alternatives. As shown in Tables 4.3-1 and 4.3-2, the shortest travel times would generally be provided with the longest BART extensions. While reductions in travel times would not be as large for minimum fundable segments as for their counterpart longer-length alternatives, the same four points discussed above for the primary alternatives would affect in vehicle and out-of-vehicle travel time relationships for the minimum fundable segments.

4.3.2 HIGHWAY TRAVEL TIMES

As the only difference between highway supply characteristics assumed for the corridor would be the provision of lanes for buses and HOV in Alternative 3, the only comparison of highway travel times presented here is of the TSM Alternative and the Bus/HOV Alternative. As the provision of HOV lanes would produce different peak-period travel times for private vehicles transporting 3 or more persons per trip (HOV) and vehicles transporting fewer than 3 persons per trip (not HOV), Table 4.3-3 shows the peak-period travel times projected for both types of travelers.

TABLE 4.3-3

HIGHWAY TRAVEL TIMES (MINUTES) FOR SELECTED ORIGINS AND DESTINATIONS /a/

				YEAR 2000 ALTERNATIVES			
				TSM /b/		BUS/ HOV /c/	
FROM :	ZONE	TO :	ZONE	MIXED FLOW LANES /d/	HOV LANES /e/	MIXED FLOW LANES /d/	HOV LANES /e/
Brentwood	(82)	- Concord	(480)	52	52	51	39
Brentwood	(82)	- Walnut Creek	(98)	65	65	64	52
Brentwood	(82)	- Bishop Ranch	(84)	72	71 /f/	69	69
Brentwood	(82)	- Oakland	(143)	104	104	102	90
Brentwood	(82)	- San Francisco	(421)	126	124	124	109
SE. Antioch	(79)	- Concord	(480)	36	36	35	23
SE. Antioch	(79)	- Walnut Creek	(98)	50	50	48	36
SE. Antioch	(79)	- Bishop Ranch	(84)	73	67 /f/	71	53
SE. Antioch	(79)	- Oakland	(143)	88	88	86	74
SE. Antioch	(79)	- San Francisco	(421)	111	108	108	93
NW. Antioch	(76)	- Concord	(480)	35	35	33	23
NW. Antioch	(76)	- Walnut Creek	(98)	48	48	46	36
NW. Antioch	(76)	- Bishop Ranch	(84)	71	65 /f/	70	53
NW. Antioch	(76)	Oakland	(143)	86	86	84	74
NW. Antioch	(76)	- San Francisco	(421)	109	106	106	94
N. Pittsburg	(565)	- Concord	(480)	26	26	25	17
N. Pittsburg	(565)	- Walnut Creek	(98)	39	39	38	30
N. Pittsburg	(565)	- Bishop Ranch	(84)	62	50 /f/	61	47
N. Pittsburg	(565)	- Oakland	(143)	77	77	76	68
N. Pittsburg	(565)	- San Francisco	(421)	94	92	98	88
N. Concord	(575)	- Concord	(480)	7	7	6	6
N. Concord	(575)	- Walnut Creek	(98)	20	20	20	20
N. Concord	(575)	- Bishop Ranch	(84)	44	38 /f/	43	37
N. Concord	(575)	- Oakland	(143)	59	59	58	58
N. Concord	(575)	- San Francisco	(421)	81	79	80	78

/a/ Times are based on the network's representation of A.M peak-period operating speeds.
/b/ Alternative 2.
/c/ Alternative 3.
/d/ Vehicles transporting fewer than 3 persons; these vehicles would not be permitted on HOV lanes.
/e/ High Occupancy Vehicles defined as transporting 3 or more persons per vehicle.
/f/ Assumes HOV lanes in both directions on I-680 between Route 24 and I-580.

Source :Pittsburg/Antioch Corridor AA/DEIS - Revised Service Level Analysis Data (Attachment to June 23, 1987 memorandum from Chuck Purvis, MTC).

For travel from the Pittsburg/Antioch Corridor to all destinations, travel times would be shorter for high-occupancy vehicles traveling on the HOV lanes than for other vehicles. Persons traveling from areas west of North Concord would not receive any travel time savings from the HOV lanes because the HOV lanes were defined to begin in Concord. In addition, high occupancy vehicles traveling to Bishop Ranch would receive a travel time reduction due to the assumed provision of HOV lanes on I-680 between Route 24 and I-580.

4.4 REGIONAL AND CORRIDOR TRAVEL PATTERNS

The ridership or usage projected for the Pittsburg/Antioch Corridor Alternatives would be affected by the following factors:

1. The forecast of households, employed residents, employment, and land uses in the corridor, the rest of Contra Costa County, and the region.

2. The projected geographic distribution of work-related and other trips from and to the corridor and other areas of the (San Francisco Bay) region.

3. The differences in total travel times and costs among the travel modes assumed to be available for journeys between the corridor and other areas of the region. The modes being compared in this analysis are driving alone, sharing a ride with one (other person, sharing a ride for two or more (other) persons, and riding transit. As an extensive discussion of the assumptions, processes, and inputs used to create the travel forecasts used in this analysis was presented in Deliverable #15/16: Travel Forecasting Results and Sensitivity Analysis, only the key conclusions of that report are presented here.

Unlike the other topics discussed in this report, which would be affected by the alternatives, the regional and corridor travel patterns discussed in this section are assumed not to change because of the alternatives. The reason for this is that the travel forecasts produced for this analysis conform with UMTA's guidelines for Alternatives Analysis stipulating the use of one home-based-work person-trip distribution for all alternatives. The accessibility and level of service variables used for the No-Action Alternative were used to create the travel forecasts for all other alternatives.

To describe the key travel demand differences between the alternatives, summary tables and graphs were prepared indicating the amount of travel projected for the following areas:

1. From and to the MTC Superdistrict (#21) representing Concord, Martinez, Pleasant Hill, and Clyde.

2. From and to the MTC Superdistrict (#24) representing West Pittsburg, Pittsburg, Antioch, and Brentwood.

3. Between each of those MTC Superdistricts and five other MTC Superdistricts representing other key destinations for trips from the Pittsburg/Antioch Corridor. Those destinations are downtown San Francisco, Oakland, Berkeley, Walnut Creek, and the San Ramon area (which includes the Bishop Ranch Business Park). The MTC Superdistricts selected for this analysis are shown in Exhibit 4.4-1.

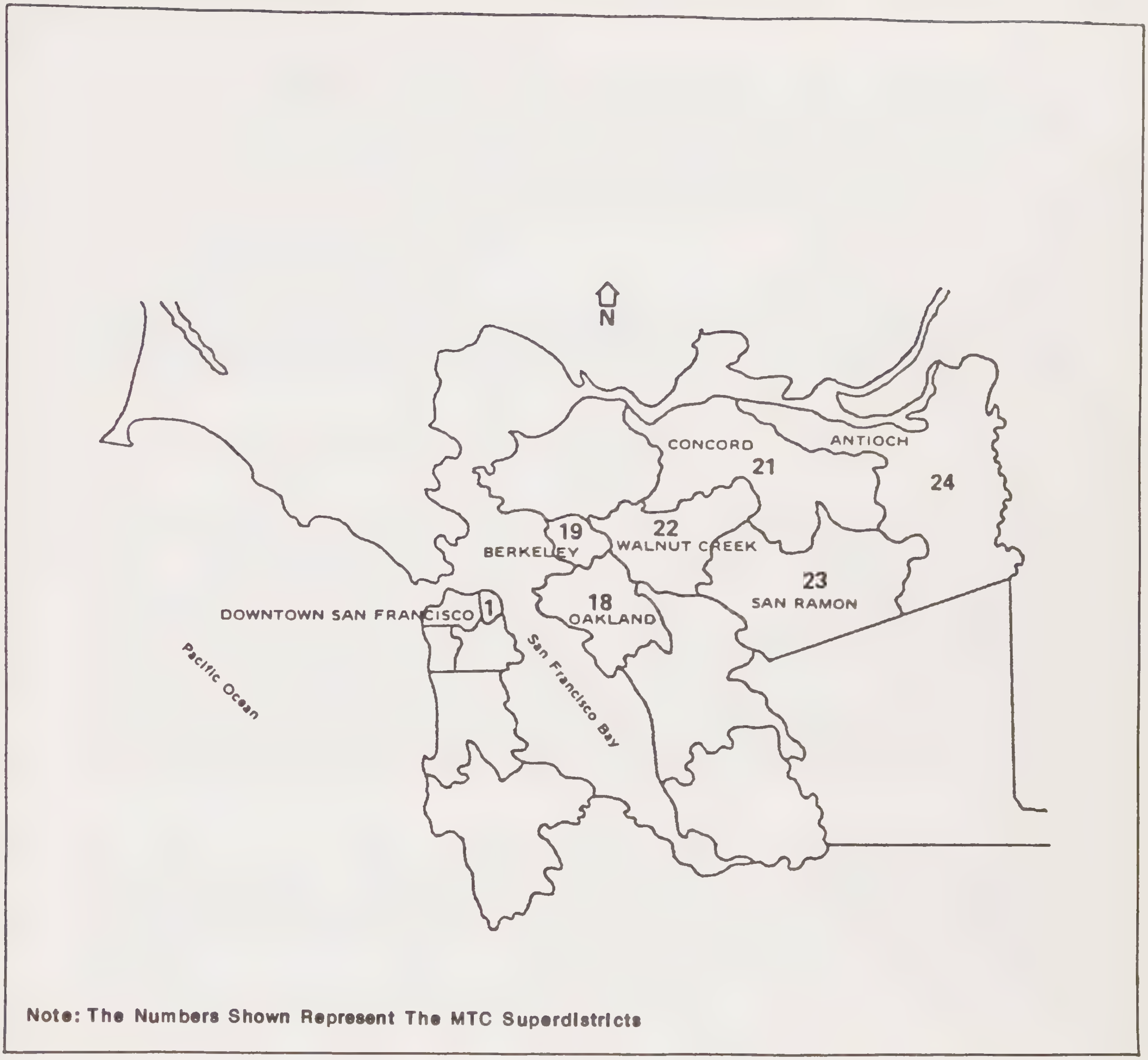
The key point of this presentation of travel patterns is to describe which travel markets the alternatives defined for the Pittsburg/Antioch Corridor would compete in and which travel markets they would not compete in. The travel time differences presented in Table 4.3-2 indicate to what extent the alternatives would offer improved travel times for transit, HOV, and general traffic modes for peak-period trips between the Pittsburg/Antioch Corridor and other areas of the region. The amount of ridership or usage projected for the alternatives would depend not only on the travel time differences between one alternative and another, but also on the total number of person trips projected to be made from or to the Corridor and other areas of the region. The number of total person-trips defines the travel market that the alternatives would or would not be affecting.

Analysis of the travel forecasts prepared by MTC for 1980 and 2000 reveals the following:[1]

1. While about 71 percent of all daily trips originating in the Concord area in the year 2000 are projected to end in the Concord area, only about 24 percent of all daily transit trips originating in the Concord area are projected to end in the Concord area. Conversely, while downtown San Francisco would attract only about 3 percent of all trips originating in the Concord area, 55 percent of all daily transit trips originating in the Concord area would be destined there. Between 1980 and 2000, while the distribution of all trips is projected to not change, the percentage of transit trips from the Concord area to downtown San Francisco is projected to increase from about 49 to 55 percent of all transit trips originating in the Concord area. (See Figures 12 through 15 in Deliverable #18--Transportation Impact Assessment.)

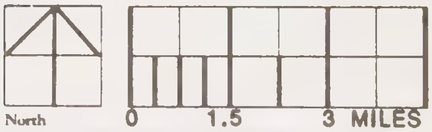
2. While about 71 percent of all daily trips originating in the Pittsburg/Antioch area in the year 2000 are projected to end there, only about 41 percent of all daily transit trips originating in the Pittsburg/Antioch area are projected to end there. Downtown San Francisco would attract only about one percent of all trips originating in the Pittsburg/Antioch area, 37 percent of all daily transit trips originating in the Pittsburg/Antioch area would be destined there. Between 1980 and 2000, while the distribution of all trips is projected not to change significantly, the percentage of transit trips from the

1 MTC produced regional forecasts of travel only for these two years for use in the analysis.



MTC's Superdistricts
Used in Analysis
Pittsburg–Antioch Corridor
AA/DEIR

Source: Barton-Aschman Associates,Inc



BART

Exhibit 4.4-1

Pittsburg/Antioch area to downtown San Francisco is projected to increase from about 28 to 37 percent of all transit trips originating in the Pittsburg/Antioch area. (See Figures 16 through 19 in Deliverable #18--Transportation Impact Assessment.)

4.5 TRANSIT RIDERSHIP (USAGE)

This section presents the differences among the alternatives in the projected use of transit. The presentation begins with corridor-level differences and proceeds from there to present more detailed differences, culminating with differences in access and egress at transit stations and park-and-ride lots.

4.5.1 CORRIDOR-LEVEL TRAVEL COMPARISONS

MTC prepared travel forecasts based on estimating the demand for travel among modes for two different types of trips: home-based-work trips and non-home-based trips.[1] The projections of total trips are based on the sum of separate projections of those two trip purposes. All of the travel forecasts prepared by MTC for these alternatives use networks representing peak-period speeds and service levels for modal choice simulation of work trips, and networks representing off-peak-period speeds and service levels for modal choice simulation of non-work trips. Those off-peak-period networks were defined not to permit auto access to transit stations because parking at some BART stations is currently unavailable after morning peak hours. The forecasts of non-work transit ridership therefore presume only walk or bus access would be possible to get to park-and-ride lots and BART or LRT stations in the corridor.

To describe the key travel demand differences among the alternatives, summary tables were created to indicate the numbers of daily total trips (on all modes and transit trips forecast to occur between the Concord and Pittsburg/Antioch areas and other areas of the region in the year 2000 for each of the alternatives and the simulation of travel that occurred in 1980. The key conclusions that can be derived from a review of those forecasts, presented in Tables 17 through 22 in Deliverable #18--Transportation Impact Assessment, are as follows:

1. Transit's shares of daily trips made from either the Concord or Pittsburg/Antioch areas to downtown San Francisco, Oakland, and Berkeley are projected to increase between 1980 and 2000.

---

1 Home-based-work trips are defined as those trips made by persons traveling directly from home to work or returning from work directly back to home. All other trips are classified as home-based-other trips or non-home-based trips.

2. Transit's share of daily trips made within the corridor is projected not to exchange.

3. Between 1980 and 2000, the numbers of total daily trips (on all modes) from the Concord area would increase by about 50 percent and from the Pittsburg/Antioch area by about 130 percent.

4. The differences between each alternative and the TSM Alternative in year 2000 one-way trips would be small, ranging from 25 to 400 daily one-way trips originating in the Concord area and from 125 to 1,025 daily one-way trips originating in the Pittsburg/Antioch area. (The forecasts for each Alternative of total daily linked transit trips and the differences between each Alternative and the TSM Alternative are presented in the next section.)

5. The BART to East Antioch or BART to North Concord/Martinez Alternatives would generate slightly more transit linked trips than the other alternatives for trips originating in the Concord area destined to downtown San Francisco, Oakland and Berkeley. Differences among the alternatives other than No-Action in transit trips would be very small for travel from the Concord area to other areas of the region.

6. The BART to East Antioch Alternative would generate the highest numbers of transitlinked trips originating in the Pittsburg/Antioch area destined to downtown San Francisco, Oakland, Berkeley, and Walnut Creek. The BART to North Concord/Martinez and LRT Alternatives would generate about 20 to 30 percent fewer of those transit linked trips, while the Busway/HOV Alternative would generate about 30 percent fewer of those transit-linked trips than the BART to East Antioch Alternative.

The major reason for the small differences in the travel forecasts between the TSM Alternative and the other alternatives is that the largest percentage increases in ridership are projected for the travel markets containing the smaller numbers of total trips. The build (or guideway) alternatives are projected to not significantly attract more trips to transit for the larger travel markets, primarily those where trips would begin and end in the Pittsburg/Antioch Corridor or Contra Costa County. For those trips, travel by automobile would continue to be the most prevalent because of the following factors:

1. Auto travel times would be much shorter than transit traveltimes because of the different components of out-of-vehicle and in-vehicle travel time required to complete a transit journey.

2. Out-of-pocket auto travel costs would be lower, partly because parking costs would be zero or low.

3. The transit alternatives were designed to improve accessibility to the BART system and the destinations it serves by improving access to the Concord BART station, either by providing more BART express bus service, building a Light Rail Line or extending BART east. The alternatives were not primarily designed to improve transit travel within the Pittsburg/Antioch Corridor or to areas of Contra Costa County not served by BART.

The BART to East Antioch Alternative is projected to generate the largest number of dailylinked transit trips because of the following reasons:

1. That alternative would provide the shortest total transit travel times from Brentwood, Antioch, Pittsburg and West Pittsburg to Walnut Creek, Concord, Oakland, and San Francisco.

2. That alternative would provide transit travel times shorter than highway travel times from Brentwood, Antioch, Pittsburg, and West Pittsburg to Oakland and San Francisco.

However, only about 17 percent of all year 2000 daily person trips originating in the Concord area (Superdistrict #21) and about 7 percent of all year 2000 daily person trips originating in the Pittsburg/Antioch area (Superdistrict #24) would be destined to the destinations served best by BART (San Francisco, Oakland, Walnut Creek). The remainder of the trips, about 83 percent of all originating in the Concord area and about 93 percent of all originating in the Pittsburg/Antioch area would be destined to places in the region where highway travel times would be shorter than transit travel times.

The corridor alternatives can be viewed as simply different ways of providing access to the regional BART system and the destinations served directly by BART. The corridor alternatives would all attract very high percentages of trips from the corridor destined to San Francisco (about 40 to 60 percent), but only a very small percentage of all person trips originating in the Corridor (about 3 percent) would be destined to San Francisco. The corridor alternatives could not be designed to provide transit traveltimes competitive with highway travel times to the areas of the region where the preponderance of trips from and to the corridor would occur.

4.5.2 ALTERNATIVE-SPECIFIC TRAVEL COMPARISONS

The forecasts of daily linked transit trips (journeys made on transit, not counting transfers separately) provide the most basic means of describing the impacts related to usage and the differences between alternatives. Table 4.5-1 presents the forecasts of dailylinked trips for the primary alternatives and minimum fundable segments.

The differences in daily linked transit trips projected for each alternative and the TSM Alternative would be as follows:

TABLE 4.5-1

DAILY LINKED TRANSIT TRIPS TO AND FROM THE PITTSBURG/ANTIOCH CORRIDOR /a/

YEAR 2000
ALTERNATIVES

	1	2	3	3A	4	4A	5	6	7	7A	7B	8
TRANSIT TRIPS	33,340	34,600	34,950	34,800	35,200	35,100	35,250	35,550	37,600	36,200	36,700	36,500

DIFFERENCES BETWEEN EACH ALTERNATIVE AND THE TSM ALTERNATIVE

	1	3	3A	4	4A	5	6	7	7A	7B	8
TRANSIT TRIPS	-1,260	350	200	600	500	650	950	3,000	1,600	2,100	1,900

/a/ A linked transit trip represents a complete journey made from each traveler's origin to each traveler's destination. Numbers shown are for travel throughout the entire region.
The Pittsburg/Antioch area is represented by MTC Superdistricts 21 and 24.

- Alternative 1 (No Build) would attract about 1,260 fewer transit trips because the TSM Alternative would include better BART express bus service (more park-and-ride lots and shorter peak-period headways).

- The Busway/HOV Lane Alternative would serve about 350 more transit trips because it would include more BART Express bus routes and those routes would be operating at higher peak-period speeds on the HOV lsnes than in mixed flow lanes. That alternative would also be the only one where peak-period travel times would be improved for a mode competing with transit, because high occupancy vehicles (HOVs) would also use the HOV lane.

- The LRT Alternatives would attract about 650 more transit trips (with the State Route 4 alignment) and about 600 more trips (with the SPTC alignment) because transit travel times would be reduced from those provided by the TSM Alternative. LRT ridership would be about 300 to 400 higher than the Busway/HOV Lane Alternatives.

- The BART to North Concord/Martinez Alternative would attract about 950 more transit trips than Alternative 2 (TSM) because access times to BART end-of-line station and hence total travel times to destinations served by BART would be reduced. The small differences in usage between this alternative and the Busway/HOV Lane and LRT Alternatives reflect the small projected differences in travel times for residents of Antioch, Pittsburg and West Pittsburg. This alternative would provide shorter travel times than the previous alternatives for residents of the North Concord/Martinez area.

- The BART to East Antioch Alternative would attract about 3,000 more daily linked transit trips than Alternative 2 (TSM) because this alternative would provide the greatest reductions in access times to BART. Those reductions would affect the entire corridor because the distances between places in the corridor and a BART station would be shortened. (Total travel times would be reduced because persons would be traveling in the corridor on BART at about 45 miles per hour rather than driving to the nearest BART station at about 20-25 miles per hour.)

- The shorter guideway alternatives would attract fewer additional riders than the primary alternatives because they would provide lower reductions in total travel times by not extending as far into the corridor as the primary alternative.

The differences created by the HOV lanes in the usage projected for all modes in the Corridor can be determined most directly by comparing the Busway/HOV Lane alternative to the TSM Alternative. As shown on Table 4.5-2, the Busway/HOV Lane Alternative would generate about 1,000 more daily home-based-work trips in vehicles transporting 3 or more persons than the TSM Alternative. (For this analysis, the HOV lanes are assumed restricted to vehicles transporting 3 or more persons.) While only forecasts of home-based-work trips occurring in vehicles transporting 3 or more persons were prepared, it is highly unlikely that the HOV lanes would generate more trips occurring in vehicles transporting 3 or more persons for other trip purposes.

TABLE 4.5-2

DAILY HOME-BASED-WORK VEHICLE PERSON AND TRANSIT TRIPS

Mode of Travel	Year 2000 Alternatives: TSM/b/	Year 2000 Alternatives: Busway/HOV/c/	Difference Between Busway/HOV and TSM Alternatives
drive alone/d/	228,230	227,195	-1,035
two per vehicle/e/	41,568	41,388	-180
three or more per vehicle/f/	19,200	20,191	991
transit	24,984	25,208	224

	TSM	Busway/HOV to Pittsburg	Difference Between Busway/HOV to Pittsburg and TSM Alternatives
drive alone	228,230	227,338	-892
two per vehicle	41,568	41,418	-150
three or more	19,200	20,075	875
transit	24,984	25,151	167

/a/ Two way trips to and from the Pittsburg/Antioch Corridor, as represented by MTC Superdistricts #21 and #24, to and from the region.

/b/ Alternative 2

/c/ Alternative 3

/d/ These trips would be made by persons traveling alone. These vehicles would not be permitted on HOV lanes.

/e/ These trips would be made by two persons traveling together. These vehicles would not be permitted on HOV lanes.

/f/ These trips would be made by three or more persons traveling together. These vehicles would not be permitted on HOV lanes.

Source: MTC, Mode Split (UFMTR Report 1), June 12, 1987.

For social, personal business, shopping and recreation trips, persons would not be sharing more rides by utilizing the HOV lanes to shorten their travel times. The HOV lanes would not provide any travel time savings to HOVs during off-peak periods, when operating speeds on State Route 4 are expected to be at or near the freeway's design speed. Conversely, the Busway/HOV Lane Alternative would generate about 1,200 fewer daily trips in vehicles transporting fewer than 3 persons. This alternative would also generate about 250 more daily home-based-work transit riders than the TSM Alternative. (Approximately 350 more daily transit trips of all purposes would be generated by the Busway/HOV Lane Alternative compared to the TSM Alternative. (See Table 4.5-1.) The Busway/HOV Lane to Pittsburg would generate about 900 more high-occupancy-vehicle trips (HOV), almost the same as the primary alternative because the HOV lanes to Pittsburg would provide a travel time reduction for HOVs on the most congested segment of State Route 4 (by Willow Pass Grade).

The transit alternatives being considered for the Pittsburg/Antioch Corridor would most directly affect ridership on BART, the LRT service options east of Concord, BART express buses, and Tri-Delta Transit routes along the corridor serving BART or LRT stations or Park-and-Ride facilities. The alternatives would determine the numbers of persons traveling on a guideway (a facility for transit or high occupancy vehicles separated from other modes of travel) and the numbers of persons using each transit station or park-and-ride lot in the corridor.

Table 4.5-3 shows the numbers of persons projected to use the guideways in the corridor east of the Concord BART station for the alternative that would contain a guideway. When comparing only the transit trips projected to use a guideway in the corridor, the BART to East Antioch Alternative would serve the highest number and the Busway/HOV Lane Alternative the lowest number, with the other primary alternatives in between those. (Guideway trips shown for the alternatives containing both LRT and BART represent only one boarding for those transferring between the guideway modes.)

The Busway/HOV Lane Alternative would serve both transit riders and persons in high-occupancy vehicles. About 5,850 persons traveling in vehicles transporting 3 or more persons are projected to use the HOV Lanes on State Route 4 during a six-hour morning and afternoon peak period. During the off-peak period when there would be more vehicles in the traffic stream transporting 3 or more persons, very few of them would find it advantageous to use the HOV lanes to reduce traveltimes. When the travelers in high-occupancy vehicles are added to the 7,300 transit riders on the buses using the Busway/HOV Lane, this alternative would serve about the same number of guideway travelers as the BART extension alternatives and more guideway travelers than the LRT alternatives.

The differences in guideway travelers would be caused by differences in ridership projected for each transit mode in the corridor. Table 4.5-4 presents the following daily boardings: on BART occurring at the Concord station and stations to the east included in the alternatives, on the two optional LRT alignments between Concord and East Antioch, on BART Express Routes "P" (which operate on State Route 4 between the Concord BART station and Antioch), and on Tri-Delta Transit buses (which are assumed to offer service between Brentwood and the Concord BART station and between the corridor and Bishop Ranch).

TABLE 4.5-3

CORRIDOR GUIDEWAY TRIPS /a/

YEAR 2000
ALTERNATIVES

	1	2	3	3A	4	4A	5	6	7	7A	7B	8
TRANSIT	/b/	/b/	7,300	7,100	8,300	8,075	8,375	10,850	13,450	12,000	13,175	11,800
HOV /c/	---	---	5,850 /d/	5,750 /d/	---	---	---	---	---	---	---	---
TOTAL	---	---	13,150	12,850	8,300	8,075	8,375	10,850	13,450	12,000	13,175	11,800

/a/ Two-way person trips occuring on BART,LRT or Express Buses and carpools on the Busway/HOV lane east of Concord Bart station.
/b/ There would not be a guideway or transitway included in this alternative east of Concord BART station.
/c/ As assumed for this analysis, only high occupancy vehicles carrying 3 or more persons would be permitted to use the HOV lanes.
/d/ Source : MTC, Mode Split (UFMTR Report 1), June 12,1987. The number shown is the forecast of AM and PM Peak-period trips and from all areas of the region west of the Corridor, and excludes trips to the Livermore Valley and half the trips to San Ramon (Superdistrict 23).

TABLE 4.5-4

TOTAL DAILY PASSENGERS BY TRANSIT OPERATOR /a/

YEAR 2000
ALTERNATIVES

OPERATOR	1	2	3	3A	4	4A	5	6	7	7A	7B	8
BART /b/	19,200	19,600	19,900	19,900	20,450	21,300	20,400	22,475	25,675	24,850	25,150	23,500
LRT	-----	-----	-----	-----	7,975	7,525	8,000	-----	-----	-----	-----	7,975
Bart Express Bus /c/	4,575	4,725	7,275	6,900	2,200	1,850	2,150	3,075	2,125	1,850	1,925	1,950
Tri Delta Transit	3,425	5,775	3,200	3,400	2,750	3,500	2,700	5,575	2,750	3,075	2,950	3,600
Total	27,200	30,100	30,375	30,200	33,375	34,175	33,250	31,125	30,550	29,775	30,025	37,025

DIFFERENCE BETWEEN EACH ALTERNATIVE AND THE TSM ALTERNATIVE

OPERATOR	1	2	3	3A	4	4A	5	6	7	7A	7B	8
BART /b/	-400		300	300	850	1,700	800	2,875	6,075	5,250	5550	3,900
LRT	--		--	--	7,975	7,525	8,000	--	--	--	--	7,975
Bart Express Bus /c/	-150		2,550	2,175	-2,525	-2,875	-2,575	-1,650	-2,600	-2,875	-2,800	-2,775
Tri Delta Transit	-2,350		-2,575	-2,375	-3,025	-2,275	-3,075	-200	-3,025	-2,700	-2,825	-2,175
Total	-2,900		275	100	3,275	4,075	3,150	1,025	450	-325	-75	6,925

/a/ Some passengers are double-counted because they would transfer between transit systems.
/b/ Only station boardings and alightings between Concord and East Antioch shown.
/c/ Only Bart Express bus boardings for "P" routes shown.

Source : MTC, UPRAS Report 3 for the Alternatives, August 1987; and Barton - Aschman Associates, Inc. for the differences between the Alternatives.

TABLE 4.5-5

DAILY ENTRIES AND EXITS AT BART STATIONS IN OR NEAR PITTSBURG/ANTIOCH CORRIDOR

BART Station	1980	YEAR 2000 ALTERNATIVES 1	2	3	3A	4	4A	5	6	7	7A	7B	8
Walnut Creek	7,325	11,075	11,300	11,400	11,400	11,475	11,440	11,475	11,350	11,700	11,500	11,600	11,325
Pleasant Hill	7,950	12,875	12,850	12,800	12,800	12,950	12,925	12,950	12,850	13,050	12,175	12,175	12,150
Concord	11,325	19,200	19,600	20,000	19,800	20,450	21,300	20,400	11,650	12,200	12,850	12,600	12,850
North Concord	----	----	----	----	----	----	----	----	10,850	5,350	5,375	5,400	11,800
West Pittsburg	----	----	----	----	----	----	----	----	----	1,050	6,625	1,100	----
Pittsburg	----	----	----	----	----	----	----	----	----	1,325	----	6,675	----
West Antioch	----	----	----	----	----	----	----	----	----	1,950	----	----	----
East Antioch	----	----	----	----	----	----	----	----	----	3,775	----	----	----

DIFFERENCE BETWEEN EACH ALTERNATIVE AND THE TSM ALTERNATIVE

BART Station	1980	1	2	3	3A	4	4A	5	6	7	7A	7B	8
Walnut Creek	-3,975	-225		100	100	175	140	175	50	400	200	300	25
Pleasant Hill	-4,900	25		-50	-50	100	75	100	0	200	-675	-675	-700
Concord	-8,275	-400		400	200	850	1,700	800	-7,950	-7,400	-6,750	-7,000	-6,750
North Concord	----	----		----	----	----	----	----	10,850	5,350	5,375	5,400	11,800
West Pittsburg	----	----		----	----	----	----	----	----	1,050	6,625	1,100	----
Pittsburg	----	----		----	----	----	----	----	----	1,325	----	6,675	----
West Antioch	----	----		----	----	----	----	----	----	1,950	----	----	----
East Antioch	----	----		----	----	----	----	----	----	3,775	----	----	----

Sources : Year 2000 Travel Forecasts - Trips By Mode and Network Assignment (Technical Summary), Fremont - South Bay Corridor and Pittsburg - Antioch Alternatives Analysis ,MTC,July 1987,Revised April 1988 page 40.
MTC, UPRAS Report 3 for the Alternatives, March 1988 ,for the 1980 entries and exits.
Barton - Aschman Associates , Inc. for the differences between the Alternatives, and for all interpolations.

Unlike previous tables, which presented the numbers of daily journeys (linked trips), Table 4.5-4 presents the number of daily passengers or unlinked trips (all boardings into transit vehicles, including transfers when required to complete a journey). The following conclusions can be derived from reviewing Table 4.5-4:

1. The LRT alternatives would generate the largest number of total boardings because transfers would be required between LRT and BART at the Concord BART station for travelers on the LRT service to complete their journeys outside the corridor. The gains in LRT ridership would be offset by losses in BART Express and Tri-Delta Transit ridership.

2. The Busway/HOV Lane Alternative would generate very few additional boardings compared to the TSM alternative because the approximately 2,500 additional boardings on BART express buses would be offset by an equal decline in Tri-Delta Transit ridership, without an increase projected in BART ridership.

3. Of the BART extension alternatives, the BART to East Antioch Alternative would generate the lowest number of total transit boardings because fewer transfers to or from BART Express or Tri-Delta Transit buses would be required to complete transit journeys into or out of the corridor. The BART extension to North Concord would generate a higher number of total transit boardings (than the East Antioch BART Alternative because the lower number of boardings on BART would be offset by a higher number of boardings on BART express and Tri-Delta buses.

The pattern described above--that ridership gains on LRT and BART would be partially offset by ridership losses on inter-city bus services in the corridor also applies to the travel forecasts for the alternatives containing shorter guideways. As shown in Table 4.5-4, the shorter LRT alternatives would generate higher transit boardings than the other shorter alternatives because there would be additional boardings to or from LRT and boardings on Tri-Delta Transit's inter-city buses would be higher than with the other alternatives.

4.5.3 ENTRIES AND EXITS AT TRANSIT STATIONS

The differences between alternatives can be presented more directly by describing the differences in usage projected for BART and LRT stations in the Pittsburg/ Antioch Corridor. Table 4.5-5 presents the numbers of daily entries and exits projected for the Walnut Creek, Pleasant Hill and Corridor BART stations. These are the trips projected to be made by persons living in the Pittsburg/Antioch Corridor who would use BART stations in the corridor to travel to and from other parts of the corridor or region, and the trips projected to be made by persons living outside the corridor who would travel to and from the corridor on BART.

The numbers of persons entering or exiting from BART stations presented in Table 4.5-5 suggest the following key conclusions:

1. Between 1980 and 2000, the numbers of persons entering and exiting from the Walnut Creek station would increase by 3,600 to 4,400 or 51 to 60 percent, and by about 5,000 or 61 to 64 percent at the Pleasant Hill station, depending on the alternative. The numbers of persons entering those stations would not vary among alternatives, but the number of persons exiting (coming from the Pittsburg/Antioch Corridor) would vary slightly by alternative.

2. Use of the Concord BART station would be affected most drastically by either the BART extension alternatives or Alternative 8. Without those extensions, the numbers of persons entering and exiting the Concord BART station would increase by 8,000 to 9,000 or about 70 to 80 percent between 1980 and 2000. With the BART extensions, the numbers of persons entering and exiting the Concord BART station would increase by less than 1,000 or only 3 to 8 percent, with riders from the Pittsburg/Antioch area using the stations east of Concord included in the BART extension alternatives.

3. Extensions of BART service east of Concord would reduce the number of daily entries and exits at the Concord BART station by at least 6,750 from the number forecast for the TSM Alternative. The other alternatives would result in slight increases in usage of the Concord BART station.

4. All other BART stations in the Corridor would generate or attract far fewer riders than the Concord BART station except for the North Concord/Martinez station, which would serve about the same number of riders as the Concord Station if it were the end-of-line station, and about 44 percent of the number of riders that would use the Concord station if BART were extended east to Antioch.

5. The differences among alternatives in the total numbers of entries and exits occurring at the Corridor BART stations (including the Concord station) would be small, reflecting the small differences in riders projected among the alternatives. The shift in total entries and exits at specific stations indicates a redistribution of riders along the corridor, rather than an absolute gain or loss.

The pattern of use projected for the Light Rail Transit stations in the corridor would be very similar to that just described for BART stations. As shown in Table 4.5-6, the highest ridership would occur at the Concord LRT station where LRT passengers would transfer to BART or travel to downtown Concord. The lowest usage would be associated with the intermediate stations. Ridership at the eastern end-of-line station would be much higher than at the intermediate stations, but lower than at the Concord LRT station.

TABLE 4.5-6

DAILY ENTRIES AND EXITS AT LIGHT RAIL STATIONS

	Year 2000 Alternatives/a/		Year 2000 Minimum Fundable Segments/b/	
	4	4A	5	8
LRT Station	LRT(4) E. Antioch	LRT(4) W. Antioch	LRT(SP) E. Antioch	BART N. Concord, LRT(4) W. Antioch
Concord	7,775	7,600	7,600	b
M.D. Hospital	400	425	425	b
North Concord	1,075	1,050	1,050	7,900
West Pittsburg	850	800	800	900
Pittsburg	1,125	1,175	1,175	1,250
West Antioch	1,575	4,625	1,425	4,800
(Central) Antioch	b	b	275	b
East Antioch	3,275	b	3,225	b

a Source: MTC Transit Assignment for the Alternatives; Barton-Aschman Associates, Inc. for all interpolations.

b Not an LRT station in this alternative.

The forecasts of access demand for each station were used to calculate the amount of parking required at each station. The forecasts of entries and exits just discussed account for trips both by residents of the corridor entering stations in their going direction and exiting from stations in their return direction and by non-residents of the corridor exiting from stations in their going direction and entering stations in their return direction. The access-demand forecasts used to calculate the number of parking spaces required, however, are based solely on the trips by residents of the corridor entering stations in the corridor. Those access-demand forecasts are also the ones that would indicate differences among alternatives in traffic volumes and levels of service at intersections near stations and park-and-ride lots.

4.5.4 TRANSIT VOLUME-TO-CAPACITY RATIOS

To describe the level of service projected to be provided to passengers on BART, LRT or BART express buses, the numbers of passengers projected were divided by the westbound a.m. peak hour capacities projected for each of those types of transit services. Two types of capacities were used in this calculation--places and seats. The following capacities measured in seated and standing passengers (places) would be provided: on buses--50; on BART trains--200 per car at 10-car trains and 13.33 trains per hour (4.5 minute headways) west of Concord station, or 200 per car at 5-car trains and 6.67 trains per hour (9 minute headways) east of Concord station;

and on LRT trains--160 per car at 2-car trains and 8 trains per hour (7.5 minute headways). Capacity measured in seats would be as follows: on buses--43, on BART trains--72 per car, and on LRT trains--68 per car.

Ratios of transit volume-to-capacity were calculated only at the Concord BART station where the maximum ridership would occur within the corridor. As shown in Table 4.5-7, the level of service on BART trains would depend directly on the assumed operating capacity at that station. With 10-car BART trains serving the Concord BART station every 4.5 minutes, 40 percent of the peak-hour seats would be filled at that station. With a 50 percent decrease in capacity assumed for the alternatives where BART would be extended east of Concord, about 89 percent of the seats would be filled at that station. (This discussion, which is for westbound (departing) trains during the a.m. peak hour would also apply to eastbound (arriving) trains during the p.m. peak hour.)

The high ratio of passengers-to-seats on BART trains is a reflection of the loading conditions that would occur at other stations as compared to the end-of-line station. If all or nearly all westbound a.m.-peak hour BART trains were to leave Concord BART station with a passenger projected for every seat, severe overcrowding would occur as more passengers would board at stations to the west. That amount of overcrowding could be reduced by placing additional trains into service or by changes in the amount of travel occurring during the peak hour. As the operating plan would provide the same BART capacity west of the Concord station with all alternatives, all alternatives are projected to have trains arriving at the Pleasant Hill BART station carrying about 0.4 peak-hour passengers per seat. Therefore, the difference in passengers per seat presented above would exist only at the Concord station. (The ratios of passengers to seats or spaces calculated for the shorter guideway alternatives would be very similar to the ratios for the longer guideway alternatives.)

During the a.m. peak hour, the LRT trains would be arriving at the Concord BART station with all seats filled and 33 percent of the passengers standing. If the service standard were to provide a seat for every peak-hour passenger, then 3-car LRT trains would have to be operated at the same headways as assumed for this analysis. If the service standard were to permit standees, then the operating plan (headways) would change from the one assumed for this analysis, depending on the assumption made about the desired ratio of passengers per seat.

BART express buses would be operating at high ratios of passengers per seat, with severe overcrowding projected for the No-Action Alternative. That overcrowding could be reduced by increasing the number of bus trips by 262 percent just to provide a seat for every projected passenger. Capital and operating cost would therefore increase in order to serve the ridership demand projected for that Alternative. The TSM and Busway/HOV Lane Alternatives would provide a seat for the peak-hour express bus passengers.

TABLE 4.5-7

TRANSIT VOLUMES AND CAPACITIES

YEAR 2000
ALTERNATIVES

BART /a/	1	2	3	3A	4	4A	5	6	7	7A	7B	8
Passenger volumes	3,485	3,570	3,650	3,600	3,760	3,625	3,750	3,875	4,275	4,000	4,100	3,800
Seat Capacity	9,600	9,600	9,600	9,600	9,600	4,800	9,600	9,600	4,800	4,800	9,600	9,600
Volume/Capacity	0.36	0.37	0.38	0.38	0.39	0.76	0.39	0.40	0.89	0.83	0.43	0.40
Place Capacity	26,665	26,665	26,665	26,665	26,665	13,335	26,665	26,665	13,335	13,335	13,335	26,665
Volume/Capacity	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.15	0.32	0.30	0.31	0.14
LRT /b/												
Passenger volumes	--	--	--	--	1,370	1275	1,360	---	---	--	--	1,400
Seat Capacity	--	--	--	--	1,024	1,024	1,024	---	---	--	--	1,024
Volume/Capacity	--	--	--	--	1.34	1.25	1.33	---	---	--	--	1.37
Place Capacity	--	--	--	--	2,560	2,560	2,560	---	---	--	--	2,560
Volume/Capacity	--	--	--	--	0.54	0.50	0.53	---	---	--	--	0.55
Bart Express Bus /c/												
Passenger volumes	450	500	1,000	900	--	---	--	---	---	--	--	--
Seat Capacity	172	516	1,204	1,204	--	---	--	---	---	--	--	--
Volume/Capacity	2.62	0.97	0.83	0.75	--	---	--	---	---	--	--	--
Place Capacity	200	600	1,400	1,400	--	---	--	---	---	--	--	--
Volume/Capacity	2.25	0.83	0.71	0.64	--	---	--	---	---	--	--	--

/a/ On BART, at Concord BART station.
/b/ On LRT, just east of the Concord Bart station.
/c/ On Bart Express bus, just east of the Concord Bart station.

Mitigation Measures

With Alternative 1 (No Build), the number of BART express bus trips operated during the peak period should be increased by 262 percent to provide a seat for every passenger projected.

If the load factor standard is to operate Light Rail Transit at fewer than 1.25 persons per seat, then all LRT Alternatives but 4A should be operated with a combination of 3-car trains and 2-car trains. Those alternatives would need about 10 percent more passenger-carrying capacity than would be provided by just operating 2-car trains.

4.5.5 MAXIMUM VOLUMES ON BART TRAINS

The required number of BART trains in service would be determined by the maximum peak-hour ridership projected, route length and peak-period headways. The numbers of a.m.-peak hour volumes on westbound BART trains on the Concord-Daly City line projected by MTC for the alternatives would be nearly identical, ranging from 10,000 for the No-Action Alternative to 10,400 for the BART to East Antioch Alternative. Those volumes were projected for the location where the maximum volumes would occur, which MTC projected to be between the 12th Street and Oakland West stations.

As the range of 400 a.m. peak-hour passengers would represent 1/5 the standing and seated capacity (places) of a 10-car BART train, the primary factor indicating the influence that the alternatives would have on BART's train requirements would be each alternative's BART route length and headways. Table 4.2-1 shows the number of BART trains projected for the Concord-Daly City line based on those factors.

4.6 HIGHWAY USAGE CHANGES AND OPERATIONAL IMPLICATIONS

The effects that the transit and HOV ridership projected for the alternatives would have on the vehicle volumes projected for State Route 4 are described in this section. The a.m.-peak hour westbound volume-to-capacity ratios calculated for three locations along State Route 4 are used at the conclusion of this section to describe the effects of the alternatives on the extent and duration of congestion.

4.6.1 A.M.-PEAK HOUR VOLUMES ON STATE ROUTE 4

As shown in Tables 4.6-1 and 4.6-2, the differences projected between the alternatives in AM-peak hour vehicle volumes assigned to State Route 4 would be small. West of Port Chicago Highway, the range of differences would be about 200 AM-peak hour westbound vehicles, or 1/10 of a freeway lane's capacity. West of Willow Pass Road, the range of differences would be about 450 vehicles or almost 1/4 of a freeway lane's capacity, a much more significant difference. East of Railroad Avenue, the range of differences would drop to about 325 vehicles or about 1/6 of a freeway lane's capacity.

TABLE 4.6-1

WESTBOUND AM-PEAK HOUR VEHICLE VOLUMES ON HIGHWAY 4

YEAR 2000
ALTERNATIVES

	1	2	3	3A	4	4A	5	6	7	7A	7B	8
WEST OF PORT CHICAGO HIGHWAY												
Mixed Flow lanes /a/	5,950	5,950	6,050	6,000	5,925	5,925	5,875	5,900	5,850	5,875	5,875	5,900
HOV lanes /b/	0	0	0	0	0	0	0	0	0	0	0	0
Total	5,950	5,950	6,050	6,000	5,925	5,925	5,875	5,900	5,850	5,875	5,875	5,900
WEST OF WILLOW PASS ROAD												
Mixed Flow lanes /a/	6,550	6,500	6,200	6,200	6,200	6,200	6,150	6,575	6,125	6,350	6,300	6,250
HOV lanes /b/	0	0	275	150	0	0	0	0	0	0	0	0
Total	6,550	6,500	6,475	6,350	6,200	6,200	6,150	6,575	6,125	6,350	6,300	6,250
EAST OF RAILROAD AVENUE												
Mixed Flow lanes /a/	4,600	4,575	4,300	4,300	4,400	4,400	4,400	4,700	4,375	4,550	4,500	4,450
HOV lanes /b/	0	0	200	0	0	0	0	0	0	0	0	0
Total	4,600	4,575	4,500	4,300	4,400	4,400	4,400	4,700	4,375	4,550	4,500	4,450

/a/ Number of vehicles assigned from the simulation of vehicular travel and estimated to use Highway 4 based on the auto-access output from the mode-of-arrival model.

/b/ Number of vehicles assigned to Highway 4 transporting more than two persons.

Source : MTC, Highway Assignment for the Alternatives.

TABLE 4.6-2

DIFFERENCES BETWEEN EACH ALTERNATIVE AND TSM ALTERNATIVE
IN WESTBOUND AM-PEAK HOUR VEHICLE VOLUMES ON HIGHWAY 4

YEAR 2000
ALTERNATIVES

WEST OF PORT CHICAGO HIGHWAY	1	3	3A	4	4A	5	6	7	7A	7B	8
Mixed Flow lanes /a/	0	100	50	-25	-25	-75	-50	-100	-75	-75	-50
HOV lanes /b/	0	0	0	0	0	0	0	0	0	0	0
	---	---	---	---	---	---	---	---	---	---	---
Total	0	100	50	-25	-25	-75	-50	-100	-75	-75	-50
WEST OF WILLOW PASS ROAD											
Mixed Flow lanes /a/	50	-300	-300	-300	-300	-350	75	-375	-150	-200	-250
HOV lanes /b/	0	275	150	0	0	0	0	0	0	0	0
	---	---	---	---	---	---	---	---	---	---	---
Total	50	-25	-150	-300	-300	-350	75	-375	-150	-200	-250
EAST OF RAILROAD AVENUE											
Mixed Flow lanes /a/	25	-275	-275	-175	-175	-175	125	-200	-25	-75	-125
HOV lanes /b/	0	200	0	0	0	0	0	0	0	0	0
	---	---	---	---	---	---	---	---	---	---	---
Total	25	-75	-275	-175	-175	-175	125	-200	-25	-75	-125

/a/ Number of vehicles assigned from the simulation of vehicular travel and estimated to use Highway 4 based on the auto-access output from the mode-of-arrival model.
/b/ Number of vehicles assigned to Highway 4 transporting more than two persons.

Source : Barton - Aschman Associates ,Inc., based on MTC Highway Assignment for the alternatives.

The volumes just described would be the differences between the BART to East Antioch Alternative, which would generate the lowest vehicle volumes on State Route 4, and the alternative generating the highest vehicle volumes on State Route 4 at each location. West of Port Chicago Highway, that alternative would be the Bus/HOV Alternative because of the projected demand by persons driving to the Concord BART station rather than riding BART express buses from Pittsburg or Antioch. (The difference between the vehicle volumes projected for State Route 4 west of Port Chicago Highway with the Bus/HOV Alternative and the No-Build or TSM Alternatives would be very small, about 100 vehicles.)

West of Willow Pass Road and east of Railroad Avenue, the BART to North Concord Alternative would generate the highest vehicle volumes on State Route 4. More persons are projected to drive to that end-of-line station than to ride buses, and that number of vehicles traveling to the station would offset some of the reduction projected for westbound a.m.-peak hour vehicle volumes on State Route 4 due to the shift to transit. (Again, the differences between alternatives would be small.)

4.6.2 LEVEL OF SERVICE ON STATE ROUTE 4

As the a.m.-peak hour westbound vehicle volumes projected for the different locations along State Route 4 would be very similar across the alternatives, the volume-to-capacity ratios also would be very similar because all alternatives were defined to consist of three general purpose lanes in each direction on State Route 4 in the corridor. During the off-peak hours, the Busway/HOV Lane Alternative could provide at least four general purpose lanes in each direction. (General purpose lanes would be available for use by all vehicles, whether HOV or not.)

As shown in Table 4.6-3, State Route 4 is projected to operate at capacity during the a.m.-peak hour west of Port Chicago Highway, slightly over capacity west of Willow Pass Road, and under capacity east of Railroad Avenue. Although each freeway segment's grade and geometrics would affect operational capacity, on the average, each freeway lane can serve 2000 vehicles per hour. Higher numbers of vehicles per hour have been counted on some freeway segments, but 2,000 vehicles per hour per lane represents the operational capacity of freeways for planning purposes. As a freeway (or any roadway) cannot carry more vehicles in an hour than its operational capacity, the vehicle assignments produced by MTC for 1980 and 2000 need to be compared to explain how congestion on State Route 4 would change.

West of Port Chicago Highway, State Route 4 in 1980 operated at a volume-to-capacity ratio of 0.86. Between 1980 and 2000, the capacity on State Route 4 is projected to increase by 50 percent (from 2 to 3 lanes), which is why the severity and duration of congestion is projected to increase by about 15 percent over the 1980 levels. West of Willow Pass Road, the 50 percent increase in capacity is projected to nearly keep pace with demand. The severity and duration of congestion in the year 2000 is projected to increase by about 10 percent with the BART to East Antioch Alternative ranging to about 17 percent with the No-Build Alternative, from the volume-to-capacity ratio of 0.93 estimated for 1980. East of Railroad Avenue, the 50 percent increase in capacity would result in about the same level of service in 2000 as in 1980.

TABLE 4.6-3

VOLUME/CAPACITY RATIOS ON HIGHWAY 4 FOR THE AM-PEAK HOUR (WESTBOUND) DIRECTION

YEAR 2000
ALTERNATIVES

WEST OF PORT CHICAGO HIGHWAY		1	2	3	3A	4	4A	5	6	7	7A	7B	8
AUTO VOLUMES	/a/	5,950	5,950	6,050	6,000	5,925	5,925	5,875	5,900	5,850	5,875	5,875	5,900
CAPACITY	/b/	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
VOLUME/CAPACITY		0.99	0.99	1.01	1.00	0.99	0.99	0.98	0.98	0.98	0.98	0.98	0.98
WEST OF WILLOW PASS ROAD													
AUTO VOLUMES	/a/	6,550	6,500	6,475	6,200	6,200	6,200	6,150	6,575	6,125	6,350	6,300	6,250
CAPACITY	/b/	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
VOLUME/CAPACITY		1.09	1.08	1.08	1.03	1.03	1.03	1.03	1.10	1.02	1.06	1.05	1.04
EAST OF RAILROAD AVENUE													
AUTO VOLUMES	/a/	4,600	4,575	4,300	4,300	4,400	4,400	4,400	4,700	4,375	4,550	4,500	4,450
CAPACITY	/b/	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
VOLUME/CAPACITY		0.77	0.76	0.72	0.72	0.73	0.73	0.73	0.78	0.73	0.76	0.75	0.74

/a/ Number of vehicles assigned from the simulation of vehicular travel and estimated to use this roadway based on the auto-access output from the mode-of-arrival model. These numbers do not include vehicles assigned to the HOV lanes.
/b/ The capacity is defined as the number of mixed-flow lanes multiplied by 2000.

Source :MTC Highway Assignment for the Alternatives.

Based on the number of high-occupancy vehicles (HOVs) assigned to the HOV lanes, those lanes would be operating at a very good level of service during the peak hour. The HOV lanes on State Route 4 would attract about 300 westbound vehicles during the a.m.-peak hour. With the capacity of those lanes defined to be about 1,600 vehicles per hour in order to maintain speeds of over 50 miles per hour, the HOV lanes would be only about 1/5 full of vehicles. Increasing the utilization of the HOV lanes as measured in vehicles could be accomplished by assuming the provision of a more extensive network of HOV lanes serving more destinations directly and/or defining HOVs as vehicles transporting 2 or more persons rather than 3 or more persons. At 3 or more persons per vehicle defining an HOV, the HOV lanes would be transporting about 2,000 persons during the peak hour, about half of those in carpools and half in express buses. By comparison, a mixed flow lane operating at capacity and typical vehicle occupancy rate of 1.1 persons per vehicle would be transporting about 2,200 persons per hour.

The Busway/HOV Lane Alternatives would serve a very small number of HOVs during off-peak hours, much smaller than the number projected for the peak periods. During off-peak hours, the lack of congestion on the general purpose lanes would not make it advantageous for HOVs to use the HOV lanes to shorten their travel times. Therefore, the HOV lanes could be opened to all traffic during the off-peak hours in order to support the following two objectives:

1. Provide HOV lanes during peak period when travel time savings for HOVs would increase the utilization of the HOV lanes to the level where the combination of persons travelling in HOVs and buses would at least equal the number of persons traveling in a general purpose lane.

2. Make the additional lanes available to all traffic during off-peak hours, when the number of HOVs and buses would be too low to justify the designation of those lanes for exclusive use by HOVs and buses.

The Busway/HOV Lane Alternatives contain a "buffer" lane extending along the entire length of the HOV lane on State Route 4 (in each direction). This lane has been designed to separate the general purpose traffic lanes from the designated HOV lane. As exclusive bus/HOV access ramps would be provided at Bailey Road, Railroad Avenue and Somersville Avenue, and as a long weaving lane would be provided at Port Chicago Highway and Hillcrest Avenue, the "buffer" lane may not be needed to serve vehicles weaving into or out of the HOV lanes.

4.6.3 VEHICLE MILES AND HOURS TRAVELED

To determine what effect the alternatives would have on vehicle miles and hours traveled, the numbers of daily vehicle hours and miles of travel assigned to freeways and arterials in Contra Costa County were summarized. The BART to East Antioch Alternative would generate the lowest number of daily vehicle miles traveled on either freeways or arterials, while the No Build Alternative would generate the highest. This difference would be caused by both the shift of person trips to transit (from private vehicles) and the reduction in the distance required to be driven by persons from the Corridor driving to a BART station. In percentage terms, the BART to East Antioch Alternative would reduce the number of vehicle miles and hours by about 3 percent on freeways and by 13 percent on arterials, all measured in relation to the TSM Alternative.

4.7 TRAFFIC AND PARKING AT STATIONS AND PARK-AND-RIDE LOTS

Two related impacts are described in this section: (1) operating conditions at intersections adjacent to transit stations and park-and-ride lots, and (2) parking supply compared to parking demand at transit stations and park-and-ride lots. These impacts are related because persons traveling to park or drop off their passengers at transit stations and park-and-ride lots would increase traffic, perhaps significantly, at nearby key intersections.

4.7.1 EXISTING AND FUTURE TRAFFIC VOLUMES

Traffic Impacts

The analysis of future traffic impacts was performed for the major streets and intersections adjacent to the transit stations and park-and-ride lots included in each of the alternatives. Before actually describing the traffic operating conditions projected for the year 2000, the following paragraphs describe the existing roadways, existing traffic volumes, and future roadways. This presentation is included to (1) indicate the basis for the projections of future traffic at intersections or roadways adjacent to stations and park-and-ride lots, and (2) identify what procedures were used to establish a consistent basis for forecasts of future traffic volumes.[1]

Existing Roadway Network

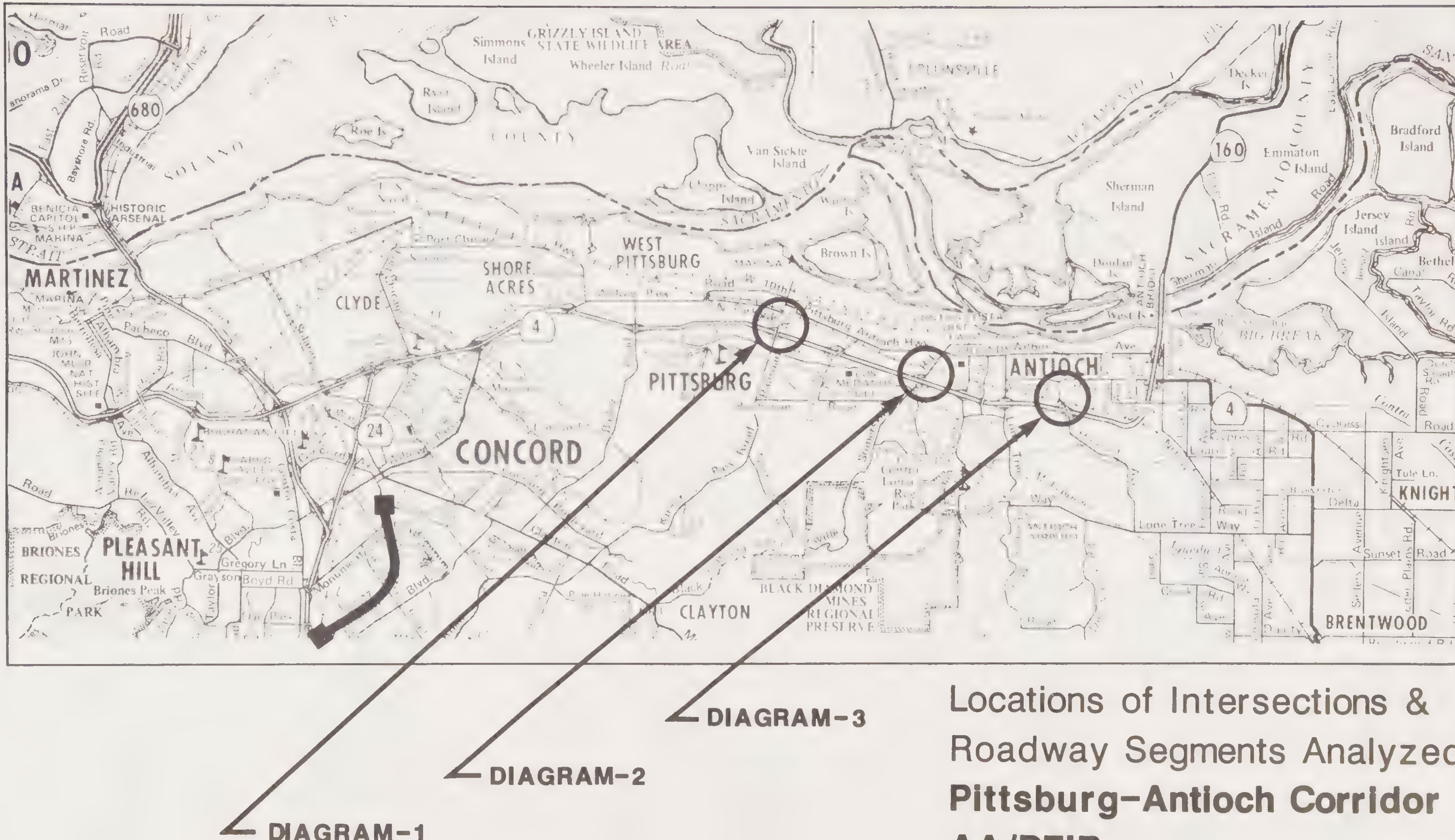
Streets near existing or proposed transit stations and park-and-ride lots range from two-lane undivided facilities to six-lane divided facilities. Exhibits 4.7-1 and 4.7-1a present the roadways serving the station areas, which are described below in order from west to east.

Concord Avenue is a four- to six-lane divided arterial with left-turn lanes that provides access from downtown Concord to State Route 242 (to and from the north) and to I-680. Concord Avenue becomes Galindo Street at Salvio Street. Galindo Street becomes Monument Boulevard south of Oakmead Drive/Cowell Road and continues to I-680 with access to and from the south. Galindo provides access to the Concord BART station via Cowell Road and Oak Street.

East Street is one-way northbound providing four through lanes between Clayton Road and Concord Boulevard. Between Concord Boulevard and Pacheco Street, East Street provides three lanes and separate left-turn lanes where appropriate. East Street is a four-lane, two-way arterial north of Pacheco Street, and provides access north to State Route 242 via Grant Street and Solano Way.

---

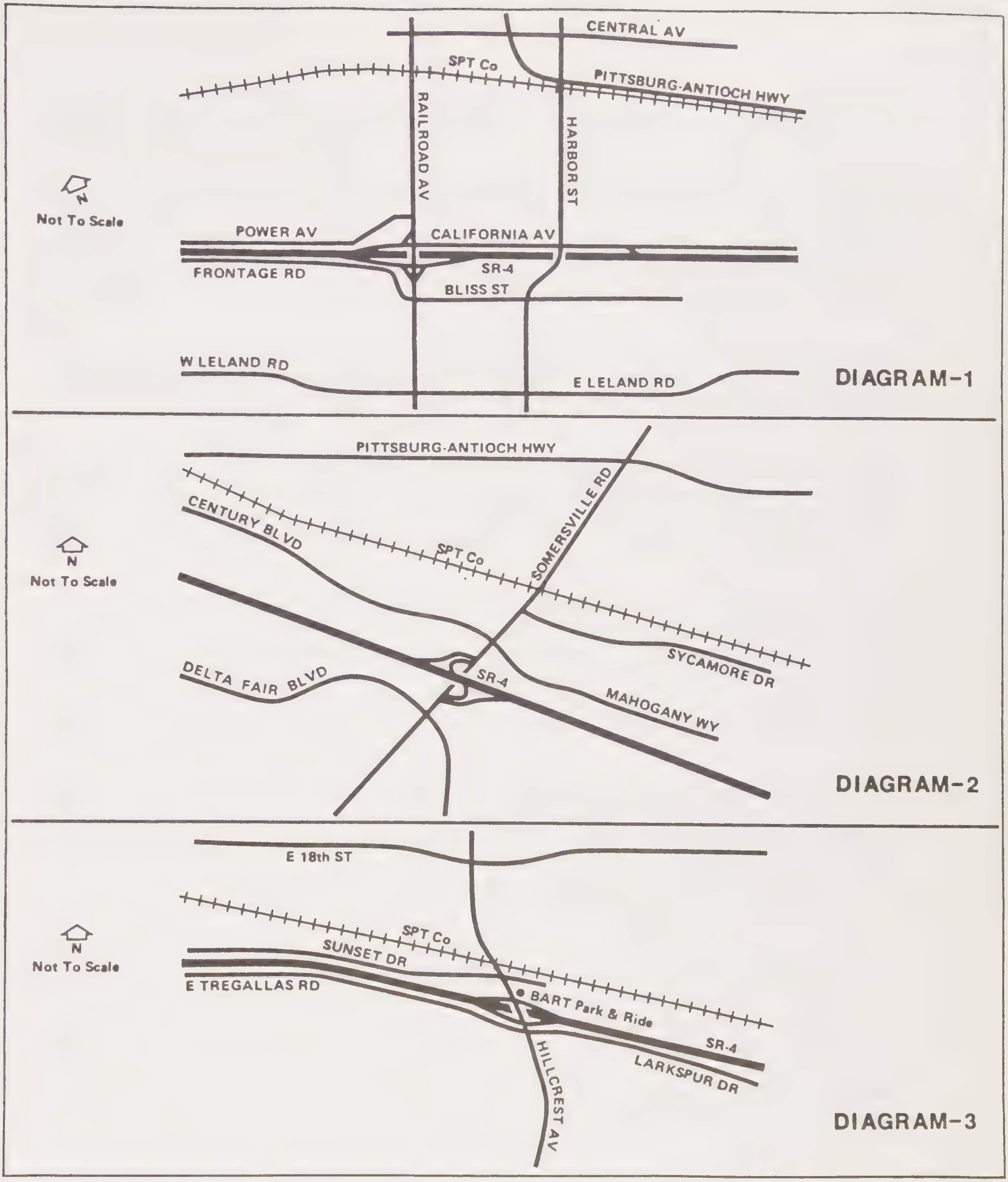
1 The local jurisdictions in the corridor were contacted to help identify roadway segments and provide traffic counts and projections.



Locations of Intersections &
Roadway Segments Analyzed
Pittsburg-Antioch Corridor
AA/DEIR

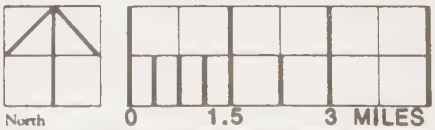
BART

Exhibit 4.7-1



Locations of Intersections &
Roadway Segments Analyzed
(Cont.)

Pittsburg–Antioch Corridor
AA/DEIR



BART

Exhibit 4.7–1a

Port Chicago Highway is a two-lane arterial between central Concord and State Route 4. This road provides the primary access to the North Concord/Martinez park-and-ride lot.

Clayton Road is a four- to six-lane divided east/west arterial that provides access to State Route 242 (to and from the south). In the vicinity of the Concord BART station, between East Street and Mira Vista Terrace, Clayton Road forms the five-lane-wide eastbound segment of a one-way couplet. East of Oakland Avenue, Clayton Road reverts to two-way, four-lane traffic flow, providing access to the east and to the town of Clayton.

The westbound leg of the one way couplet is Concord Boulevard, which is a four-lane facility, one way westbound between Port Chicago Highway and Mira Vista Terrace. East of Port Chicago Highway, Concord Boulevard is a two way road, providing access to and from eastern Concord and Clayton.

Willow Pass Road is a four- to six-lane divided arterial in Concord, providing access to I-680. Evora Road provides access is the two-lane continuation of Willow Pass Road north of State Route 4 to west Pittsburg, where Willow Pass Road begins again. The two-lane cross-section of Willow Pass road in eastern Contra Costa County contains left turn lanes.

Bailey Road is a two-lane, north/south arterial between Clayton Road in Concord and West Leland Road in Pittsburg. North of West Leland Road to Willow Pass Road, Bailey Road is a four-lane divided roadway with separate left-turn lanes. Access is provided to and from State Route 4 in both east and west directions north of West Leland. The West Pittsburg Park-and-Ride Lotis located off of Bailey Road south of the State Route 4 interchange. A two-lane bridge on Bailey Road north of Canal Road can restrict future roadway capacity.

West Leland Road is a four-lane, east/west, divided arterial with separate left-turn lanes that runs parallel to State Route 4 from west of Bailey Road to east of Somersville Road where it connects with Buchanan Road. However, between these two locations, West Leland has two name changes. East of Railroad Avenue, West Leland becomes East Leland, while at Century Boulevard, East Leland becomes Delta Fair Boulevard, which then continues east of Somersville Road to Buchanan Road.

Railroad Avenue is a north/south, four-lane arterial in Pittsburg with separate left turn lanes that connects Marina Boulevard north of State Route 4 to Buchanan Road in the south. South of Buchanan Road, Railroad Avenue becomes Kirker Pass Road, which intersects with Clayton Road in Concord. South of Clayton Road, Kirker Pass becomes Ygnacio Valley Road continuing south into Walnut Creek and I-680. In Pittsburg, access is provided to State Route 4 from Railroad Avenue north of Leland Road. That interchange does not contain a westbound off-ramp. Vehicles traveling westbound on State Route 4 must exit onto California Avenue east of Harbor Road and access Railroad Avenue from California Avenue.

Harbor Street is a north/south, four-lane arterial in Pittsburg, with separate left turn lanes that connects Buchanan Road south of State Route 4 to East 3rd Street north of State Route 4. There is no access to State Route 4 along Harbor Road.

Somersville Road is a north/south four-lane divided roadway between Buchanan Road and West 10th Street, which in this section also contains left-turn lanes. Somersville Road has a two-lane cross-section south of Buchanan Road into the Black Diamond Mines Regional Preserve, and north of West 10th Street. Access to State Route 4 is provided by a full interchange located on Somersville Road, north of Delta Fair Boulevard.

Century Boulevard is a four-lane east/west roadway connecting Delta Fair Boulevard near Standard Oil Avenue south of State Route 4 to Somersville Road via an underpass near Standard Oil Avenue. East of Somersville Road, Century Boulevard becomes a two-lane facility named Mahogany Way.

A Street is an east/west four-lane roadway with separate left-turn lanes. Access to and from State Route 4 is achieved via a full interchange south of Bryan Avenue. South of the interchange, A Street becomes Lone Tree Way, which extends south then turns east toward Brentwood.

Hillcrest Avenue is a two-lane north/south roadway with separate left-turn lanes. Hillcrest Avenue extends north past East 18th Street and southeast to Lone Tree Way near Brentwood. Access to State Route 4 is possible at a full interchange north of Larkspur Drive. The East Antioch park-and-ride lot is located north of the interchange at Sunset Drive.

4.7.2 LEVEL OF SERVICE DEFINITION

The p.m. peak hour is the critical period of travel on most roadways in the Corridor based upon a comparison of existing a.m. and p.m. peak-hour counts. Traffic volumes are generally higher during this period because they include both work and non-work trips (shopping, school, business, etc.).

The Highway Capacity Manual, 1985 Edition was used to determine roadway link capacities. As the traffic analysis is based on the peak direction of flow, link capacities represent one-way capacities. Signals are assumed to control the effective capacity of each road link.

A different methodology was used to analyze the intersections in Concord. The "Circular 212 Planning" method was used to assess the levels of service at these intersections, to be consistent with previous traffic analyses in Concord.

Capacity for intersections and roadway segments (links) were defined based on the appropriate methodology being used to calculate existing and future levels of service. A Level of Service (LOS) was determined from the capacity calculations based upon volume-to-capacity (V/C) ratios for both links and intersections. The term "Level of Service" describes the operation of an intersection or road link using letter "grades" ranging from A to F. LOS A represents free-flow conditions where there is no delay to vehicles, and LOS F represents complete breakdown of the intersection or roadway. Table F-3 (Appendix F) presents a description of the Levels

of Service used in this study, while Table 4.7-1 provides a summary of the existing volume-to-capacity ratios and Levels of Service.

Typically, LOS D is considered the minimally acceptable level at which intersections should operate during peak traffic conditions in urban areas. The City of Concord has an ordinance that requires this condition be met before new developments can occur. This analysis uses LOS D as the standard to which roadways should be designed and mitigations developed.

4.7.3 EXISTING TRAFFIC VOLUMES

As no new traffic counts were taken as a part of this study, existing data obtained from local jurisdictions were used for the analysis of traffic. Intersection volume data were available at only a few locations in all cities, but for all key intersections in Concord.

Several intersections near the BART station in downtown Concord were initially identified by the City of Concord as possibly being significantly impacted during the p.m. peak hour by the proposed Alternatives. The downtown Concord BART station was analyzed in a recently published DEIR prepared for the joint development of the Concord BART station.[1] That study projected the following conditions for the key intersections around the Concord BART station:

Intersection	Future PM Peak Hour Level of Service
Oakland/Clayton Road	D
East-Port Chicago-Park/Clayton Road	D
Oak-Laguna/Galindo	A/B
Port Chicago/Concord Boulevard	A
Port Chicago/Willow Pass	B

Those projections of future conditions (for approximately the year 2000) indicate that all but the Oakland/Clayton Road and East-Port Chicago-Park/Clayton Road intersections would operate at acceptable Levels of Service (LOS). That analysis of future conditions assumed the provision of 2,600 parking spaces at the Concord BART station, which is similar to the parking capacity assumed for the BART extension alternatives. The addition of another 1,000 spaces, which is assumed for the alternatives where BART would not be extended east from Concord, would increase traffic at all intersections. However, those intersections projected to operate at Level of Service A or B in the future would still operate at Level of Service C or better even with the incremental traffic attracted to a larger parking supply. Thus, the two critical intersections, Oakland/Clayton Road and East-Port Chicago-Park/Clayton Road, are the ones analyzed in this study.

---

1 Mundie and Associates, Concord BART Station Area DEIR, March 1988.

TABLE 4.7-1

EXISTING LEVEL OF SERVICE[a]

	PM Peak Hour	
	V/C	LOS
Concord Station		
Oakland/Clayton	0.89	D
Port Chicago-East-Park/Clayton	0.48	A
North Concord Station		
Port Chicago Hwy/Olivera Road	0.96	E
West Pittsburg Station		
Bailey north of Leland	0.50	A
Bailey south of Canal Road	0.46	A
Bailey south of Willow Pass	0.27	A
Willow Pass east of Port Chicago	1.29	F
Willow Pass west of Bailey	1.02	F
Willow Pass east of Bailey	0.81	D
Pittsburg Station		
Railroad south of E. Leland	0.53	A
E. Leland east of Railroad	0.32	A
E. Leland west of Railroad	0.43	A
Railroad north of Bliss	0.79	D
Bliss east of Railroad	0.44	A
Railroad Avenue on the overpass	0.61	B
Railroad Avenue north of California	0.64	B
Power (Center) west of Railroad	0.33	A
Solari north of Central	0.74	C
Central west of Solari	0.51	A
Harbor north of California	0.32	A
California west of Harbor	1.12	F
California east of Harbor	1.40	F
Harbor north of Leland	0.33	A
Harbor south of Leland	0.32	A
E. Leland east of Harbor	0.35	A
West Antioch Station		
Somersville south of Delta Fair	0.44	A
Somersville north of Delta Fair	0.77	C
Somersville south of Century	0.57	A
Somersville north of Century	0.39	A
Somersville south of 10th	0.32	A

TABLE 4.7-1 (Continued)

	PM Peak Hour	
	V/C	LOS
A Street Station		
A Street south of 18th	0.42	A
A Street north of Bryan	0.61	B
A Street south of Bryan	0.63	B
East Antioch		
Hillcrest south of Larkspur	0.61	B
Hillcrest north of Larkspur	0.97	E
Hillcrest south of 18th	0.36	A

Source: Barton-Aschman Associates, Inc. 1988.

a Based on most recent traffic counts available.

The Port Chicago Highway/Olivera Road intersection was determined by the City of Concord to be the critical intersection in the vicinity of the North Concord/Martinez station. That intersection, located south of the proposed North Concord/Martinez BART station, is operating at Level of Service E.[2] Existing intersection traffic volumes for the three Concord intersections, which were used to determine the existing Levels of Service, are shown in Figure F-1 (Appendix F).

Table 4.7-1 provides the p.m. peak hour existing level of service for roadways impacted by station traffic. During the p.m. peak hour, Willow Pass Road east of Port Chicago Highway operates at Level of Service F, as does California east and west of Harbor, and the Port Chicago Highway/Olivera intersection operates at LOS E. All other intersections and road segments operate at Level of Service D or better.

4.7.4 ROADWAY IMPROVEMENTS

There are several planned or programmed changes to existing roadways that would affect future roadway conditions. Each jurisdiction in the corridor was contacted to obtain a list of roadway improvements planned to be implemented by 2000. The most important ones are described below.

2 Foulk, Brian Kangas, Traffic Impact Analysis for Proposed Navy Family Housing, January 1988.

The City of Concord is proposing roadway modifications to the existing street network to increase capacity to serve traffic in downtown Concord. The modifications--designed to serve the traffic demands of future projects--include physical improvements (such as widening existing roadway or adding new roadways), reversing street flow, and adding signals to currently unsignalized intersections. Physical improvements scheduled to occur within the time frame of this study are identified and described in Appendix F. Some of those projects are not funded. However, development levels included in the Concord BART station Joint Development Study are tied to those roadway improvements because the roadway improvements must occur to provide the capacity and levels of service necessary to meet City standards. A funding mechanism is in place to assess future land developments to help pay for those roadway projects.

The following changes in direction of flow are proposed and scheduled to occur by 1990:

- Bonifacio and Pacheco will be converted from two way streets to a one-way couplet, with Bonifacio one-way westbound and Pacheco one-way eastbound.

- With the completion of Port Chicago Highway through to Clayton Road, Port Chicago Highway will become one way northbound from Clayton Road to Bonifacio and East Street will be changed from one-way northbound to one-way southbound between Pacheco Street and Clayton Road. North of Pacheco-Bonifacio, both Port Chicago Highway and East Street will remain two-way.

- Colfax will change from one-way southbound between Pacheco Street and Clayton Road to two-way between Pacheco Street and Concord Boulevard and one-way northbound between Clayton Road and Concord Boulevard.

Mitigations that were developed as part of the Navy Housing Study and the Concord BART station Joint Development Study that have been assumed to be completed for this analysis are the following:

- Port Chicago Highway/Olivera Road. There are two conditions that were considered for this intersection--one without a new bypass road and the other with a bypass road. A bypass road paralleling Olivera Road between Port Chicago Highway and Willow Pass Road has been proposed as a possible mitigation to the impacts of future traffic volumes associated with the buildout of the Navy Housing project (up to 1,370 multi-family dwelling units) and general growth in this part of Contra Costa County. This proposal has not been adopted by the City of Concord, and a decision on its implementation will not occur until 1992 when the ultimate size of the Navy Housing project is determined.[1] The conclusions of the traffic impact report were that with full development

[1] Peipers, Richard, Director of Facilities Planning, Public Works Department, Concord Naval Weapons Station, April 1988.

of the Navy Housing project the bypass road would be required to mitigate the impacts of the project. Since full buildout of the Navy Housing project has been assumed in the traffic volumes used to analyze the impacts in this study, the bypass road is assumed to be constructed.

Mitigation measures required in the future with the buildout of the Concord BART station area would include the following:

- Port Chicago-East-Park/Clayton. At this intersection, the left turn from eastbound Clayton to Park would be prohibited.

- Oakland/Clayton. At this intersection, a new right-turn lane from Clayton to Oakland would be required so that an additional third eastbound through lane could be added. On the south leg, there would have to be two left turn lanes, a shared through/right-turn lane, and an exclusive right turn lane. The city would require that the signal be operated as a five-phase signal to coordinate with the signals in the downtown area. The city is recommending that a pedestrian overcrossing be built to eliminate pedestrian movements across Clayton Road, as pedestrian volumes would require too much signal time with this signal cycle and would significantly interfere with turning movements.

In West Pittsburg, Willow Pass Road is scheduled to be widened from a two- to a four-lane cross-section from State Route 4 to east of Bailey Road sometime between 1992 and 1995. Bailey Road is scheduled to be widened to a four-lane cross-section north of State Route 4. In Antioch, Hillcrest Avenue is scheduled to be widened from a two- to a four-lane cross-section.

4.7.5 FORECASTS OF FUTURE BACKGROUND ROADWAY VOLUMES

To develop volumes of future traffic not related to the corridor transit alternatives from existing volumes, twenty year growth factors were determined by comparing volumes from the MTC model runs for the year 2000 and the year 1980 for road links near each station. Separate growth factors were developed for each of the station areas in the corridor to account for different growth patterns in different parts of the corridor. The growth factors were then annualized and applied to the appropriate existing volumes. The volumes that resulted were defined as year 2000 volumes to which auto access/egress volumes would be added. The annual growth factors ranged from 2% per year at the Pittsburg station to 5% at the East Antioch station.

4.7.6 AUTO ACCESS VOLUMES

P.M. peak hour vehicle access trips to and from each station or park-and-ride lot include trips by persons who would be entering or exiting transit stations and park-and-ride lots during the p.m. peak hour on private vehicles either as drivers or as passengers. The p.m. peak-hour auto access trips to and from the stations were estimated based upon assumptions of the percentage of daily travel occurring in the p.m. peak hour, current auto occupancy data and forecasts of park-and-ride and pick-up and drop-off trips.

Table 4.7-2 presents a summary of the vehicle access trips associated with each transit station or park-and-ride lot for each alternative. Those volumes were assigned to the road network based upon the origins of the trip and the road network serving the station, and were then added to the background traffic discussed above.

Calculations of future roadway capacity were performed in a manner similar to what was done for existing conditions. The capacity calculations were performed with the assumption that roadway improvements and mitigation measures would be implemented. The resulting volume-to-capacity ratios and corresponding Levels of Service are summarized in Table 4.7-3 for all alternatives.

There would be unsatisfactory operating conditions on some of the road links associated with growth in background traffic that, not being related to the alternatives, would be the same for all alternatives, as follows:

- Willow Pass Road west of Bailey Road is projected to operate at LOS F, even with the increased capacity being proposed.

- Railroad Avenue north of Bliss Street (south of the State Route 4 interchange) is projected to operate at capacity (LOS E).

- California Avenue between Harbor Street and Railroad Avenue is projected to operate at LOS F.

- Somersville Road north of Delta Fair Boulevard in the vicinity of the State Route 4 interchange is projected to operate at LOS F.

4.7.7 OPERATING CONDITIONS AT INTERSECTIONS ASSOCIATED WITH THE ALTERNATIVES (TRAFFIC IMPACTS)

Differences among alternatives would be very small for the following reasons:

1. The number of total p.m. peak-hour vehicle trips associated with access to the BART system would not be very different among alternatives because the number of linked person trips assigned to BART would not be very different among alternatives. As a result, the number of p.m. peak-hour vehicle trips associated with access to the BART system at each freeway interchange where a BART or LRT station or bus park-and-ride lot would be included in different alternatives would be very similar. Approximately the same number of vehicle access trips would be traveling past the key intersections adjacent to State Route 4, even though the vehicles would be traveling to get access to different types of transit service.

TABLE 4.7-2

PM-PEAK HOUR AUTO TRIPS TO BART OR LRT STATIONS OR EXPRESS BUS TERMINALS

YEAR 2000
ALTERNATIVES

Station/Terminal	1 In/Out	2 In/Out	3 In/Out	3A In/Out	4 In/Out	4A In/Out	5 In/Out	6 In/Out	7 In/Out	7A In/Out	7B In/Out	8 In/Out
Concord	445/2,160	435/2,105	375/1,810	375/1,810	355/1,715	355/1,715	355/1,715	250/1,215	250/1,215	250/1,215	250/1,215	285/1,395
North Concord	----	----	----	----	0/0 /b/	0/0 /b/	0/0 /b/	----	----	----	----	----
West Pittsburg	0/5	0/30	/a/	/a/	10/155	10/155	15/160	105/1,330	70/880	70/880	70/880	70/880
Pittsburg	0/10	0/5	5/60	5/60	5/90	5/90	5/90	0/0	10/120	70/760	10/120	5/70
West Antioch	----	----	10/130	35/550	10/125	10/125	10/130	----	10/150	----	65/810	10/100
West Antioch	----	----	----	----	15/215	40/535	15/215	----	25/280	----	----	30/405
Antioch (A Street)	----	----	----	----	-----	----	0/0 /b/	----	----	----	----	----
East Antioch	10/95	10/125	20/265	----	25/320	----	25/315	10/10	35/420	----	----	----

/a/ BART Express buses would not stop at this park-and-ride lot with this alternative.

/b/ Parking would not be provided at this station.

/c/ No auto access trips were assigned to this station, because MTC coded the network for this alternative to not have parking at this station. The capitol cost estimate for this alternative is based on providing about 200 parking spaces at this station.

Source : Barton - Aschman Associates , Inc. from MTC transit assignment based on the auto access output from the mode-of-arrival modal.

TABLE 4.7-3

Summary of Volumes and Levels of Service By Alternative

	Existing			1			2			3		
	Vol.	V/C	LOS	Vol.	V/C	LOS	Vol.	V/C	LOS	Vol.	V/C	LOS
Downtown Concord/a/												
Port Chicago-East-Park/Clayton		0.48	A		0.83	D		0.83	D		0.81	D
Oakland/Clayton/a/		0.89	D		0.93	E		0.92	E		0.86	D
North Concord Station												
Port Chicago/Olivera Road		0.96	E		0.83	D		0.82	D		0.81	D
West Pittsburg Station												
Bailey North of W.Leland	950	0.50	A	1,540	0.81	D	1,550	0.81	D	1,530	0.81	D
Bailey South of Canal	870	0.46	A	1,410	0.74	C	1,410	0.74	C	1,410	0.74	C
Bailey South of Willow Pass	510	0.27	A	860	0.45	A	860	0.45	A	0.860	0.45	A
Willow Pass East of Port Chicago	1,160	1.29	F	1,950	1.03	F	1,950	1.03	F	1,940	1.03	F
Willow Pass West of Bailey	920	1.02	F	1,530	0.81	D	1,530	0.81	D	1,520	0.80	C
Pittsburg Station/c/												
Railroad South of Leland	1,010	0.53	A	1,270	0.67	B	1,280	0.67	B	1,280	0.68	B
Railroad North of Bliss	1,430	0.79	C	1,800	1.0	E	1,800	1.00	E	1,810	1.00	E
Railroad on Overpass	1,150	0.61	B	1,450	0.76	C	1,450	0.76	C	1,500	0.79	C
Railroad North of California	1,220	0.64	B	1,520	0.80	C	1,530	0.80	C	1,580	0.83	D
Harbor South of Leland	610	0.32	A	910	0.48	A	910	0.48	A	910	0.48	A
Harbor North of Leland	620	0.33	A	910	0.48	A	910	0.48	A	910	0.48	A
Bliss East of Railroad/d/	310	0.44	A	390	0.56	A	410	0.59	A	470	0.67	B
Power West of Railroad	230	0.33	A	300	0.42	A	320	0.46	A	380	0.54	A
Central West of Solari/e/	720	0.51	A	890	0.64	B	890	0.64	B	890	0.64	B
Solari North of Central/e/	670	0.74	C	830	0.92	E	830	0.92	E	830	0.92	E
California East of Harbor	1,260	1.40	F	1,840	2.05	F	1,840	2.05	F	1,840	2.05	F
California West of Harbor	710	1.12	F	1,150	1.64	F	1,150	1.64	F	1,150	1.64	F
E. Leland East of Harbor	670	0.35	A	980	0.52	A	980	0.52	A	990	0.52	A
E. Leland West of Harbor	610	0.32	A	760	0.40	A	750	0.40	A	760	0.40	A
E. Leland West of Railroad	780	0.43	A	970	0.54	A	970	0.54	A	980	0.54	A
West Antioch Station												
Somersville South of Delta Fair	840	0.44	A	1,130	0.60	A	1,130	0.60	A	1,140	0.60	A
Somersville North of Delta Fair	1,460	0.77	C	1,980	1.04	F	1,980	1.04	F	2,010	1.06	F
Somersville South of Century	1,080	0.57	A	1,460	0.77	C	1,480	0.78	C	1,540	0.81	D
Somersville North of Century	740	0.39	A	1,000	0.52	A	1,000	0.52	A	1,540	0.81	D
Somersville South of 10th	580	0.32	A	780	0.43	A	780	0.43	A	780	0.43	A
A Street Station												
A Street South of 18th	800	0.42	A	1,200	0.63	B						
A Street North of Bryan	1,150	0.61	B	1,720	0.91	E		N/A			N/A	
East Antioch Station												
Hillcrest South of Larkspur	550	0.61	B	1,050	0.55	A	1,050	0.55	A	1,070	0.56	A
Hillcrest North of Larkspur	870	0.97	E	1,650	0.87	D	1,650	0.87	D	1,670	0.88	D
Hillcrest South of 18th	320	0.36	A	620	0.33	A	630	0.33	A	630	0.33	A

TABLE 4.7-3

Summary of Volumes and Levels of Service By Alternative (Continued)

	3A/b/			4			4A/b/			5		
	Vol.	V/C	LOS	Vol.	V/C	LOS	Vol.	V/C	LOS	Vol.	V/C	LOS
Downtown Concord/a/												
Port Chicago-East-Park/Clayton		N/A			0.80	C		N/A			0.80	C
Oakland/Clayton/a/					0.83	D					0.83	D
North Concord Station												
Port Chicago/Olivera Road		N/A			0.86	D/e/		N/A			0.86	D/e/
West Pittsburg Station												
Bailey North of W.Leland				1,550	0.82	D				1,550	0.81	D
Bailey South of Canal				1,410	0.74	C				1,420	0.75	C
Bailey South of Willow Pass		N/A		880	0.46	A		N/A		880	0.46	A
Willow Pass East of Port Chicago				1,950	1.03	F				1,950	1.03	F
Willow Pass West of Bailey				1,530	0.81	D				1,530	0.81	D
Pittsburg Station/c/												
Railroad South of Leland	1,350	0.71	C	1,260	0.68	B				1,290	0.68	B
Railroad North of Bliss	1,840	1.02	F	1,810	1.01	E				1,810	1.01	F
Railroad on Overpass	1,490	0.78	C	1,460	0.79	C				1,460	0.77	C
Railroad North of California	1,600	0.84	D	1,540	0.81	D				1,540	0.81	D
Harbor South of Leland	920	0.48	A	910	0.48	A				910	0.48	A
Harbor North of Leland	920	0.48	A	910	0.48	A				910	0.48	A
Bliss East of Railroad/d/	710	1.01	F	460	0.66	B				390	0.56	A
Power West of Railroad	620	0.89	F	370	0.52	A		N/A		290	0.41	A
Central West of Solari/e/	890	0.64	B	980	0.70	B				980	0.70	C
Solari North of Central/e/	830	0.92	E	830	0.92	E				830	0.92	E
California East of Harbor	1,850	2.06	F	1,840	2.05	F				1,840	2.05	E
California West of Harbor	1,160	1.66	F	1,150	1.64	F				1,150	1.64	F
E. Leland East of Harbor	980	0.52	A	980	0.52	A				980	0.52	A
E. Leland West of Harbor	800	0.43	A	770	0.40	A				770	0.40	A
E. Leland West of Railroad	1,010	0.56	A	980	0.54	A				980	0.54	A
West Antioch Station												
Somersville South of Delta Fair				1,140	0.60	A	1,10	0.62	B			
Somersville North of Delta Fair				2,020	1.06	F	2,120	1.12	E	2,020	1.06	F
Somersville South of Century		N/A		1,560	0.82	D	1,740	0.92	E	1,560	0.82	D
Somersville North of Century				1,020	0.54	A	1,020	0.54	A	1,020	0.54	A
Somersville South of 10th				800	0.44	A	800	0.44	A	790	0.44	A
A Street Station												
A Street South of 18th				1,210	0.63	B						
A Street North of Bryan		N/A		1,750	0.92	E		N/A			N/A	
A Street South of Bryan				1,810	0.95	E						
East Antioch Station												
Hillcrest South of Larkspur				1,070	0.56	A				1,060	0.56	A
Hillcrest North of Larkspur		N/A		1,670	0.88	D		N/A		1,660	0.88	D
Hillcrest South of 18th				630	0.33	A				630	0.33	A

TABLE 4.7-3

Summary of Volumes and Levels of Service By Alternative (Continued)

	6			7			7A/b/			7B/b/		
	Vol.	V/C	LOS	Vol.	V/C	LOS	Vol.	V/C	LOS	Vol.	V/C	LOS
Downtown Concord/a/												
Port Chicago-East-Park/Clayton		0.78	C		0.78	C		N/A			N/A	
Oakland/Clayton/a/		0.79	C		0.79	C						
North Concord Station												
Port Chicago/Olivera Road		0.84	D		0.84	D		N/A			N/A	
West Pittsburg Station												
Bailey North of W. Leland	1,550	0.82	D	1,550	0.82	D	1,740	0.92	E			
Bailey South of Canal	1,410	0.74	C	1,430	0.75	C	1,560	0.82	D			
Bailey South of Willow Pass	860	0.45	A	900	0.47	A	990	0.52	A		N/A	
Willow Pass East of Port Chicago	1,950	1.03	F	1,960	1.03	F	2,070	1.09	F			
Willow Pass West of Bailey	1,530	0.81	D	1,530	0.81	D	1,650	0.87	D			
Pittsburg Station/c/												
Railroad South of Leland	1,260	0.66	B	1,300	0.68	B				1,490	0.78	C
Railroad North of Bliss	1,790	0.99	E	1,820	1.01	F				1,980	1.04	F
Railroad on Overpass	1,440	0.76	C	1,470	0.77	C				1,890	0.99	E
Railroad North of California	1.520	0.80	C	1,550	0.82	D				2,000	1.05	F
Harbor South of Leland	910	0.48	A	910	0.48	A				960	0.50	A
Harbor North of Leland	910	0.48	A	910	0.48	A				920	0.48	A
Bliss East of Railroad/d/	390	0.56	A	490	0.67	B				950	1.35	F
Power West of Railroad	290	0.41	B	400	0.56	A		N/A		860	1.23	F
Central West of Solari/e/	890	0.64	B	890	0.64	B				890	0.64	B
Solari North of Central/e/	830	0.92	E	830	0.92	E				830	0.92	E
California East of Harbor	1,840	2.05	F	1,840	2.05	F				1,860	2.07	E
California West of Harbor	1,150	1.64	F	1,150	1.64	F				1,170	1.67	F
E. Leland East of Harbor	990	0.52	A	990	0.52	A				1,020	0.42	A
E. Leland West of Harbor	760	0.40	A	770	0.40	A				790	0.42	A
E. Leland West of Railroad	970	0.54	A	980	0.54	A				1,030	0.57	A
West Antioch Station												
Somersville South of Delta Fair	1,130	0.60	A	1,150	0.61	B						
Somersville North of Delta Fair	1,980	1.04	F	2,040	1.08	F						
Somersville South of Century	1,460	0.77	C	1,600	0.84	D		N/A			N/A	
Somersville North of Century	1,000	0.52	A	1,020	0.54	A						
Somersville South of 10th	780	0.43	A	810	0.45	A						
A Street Station												
A Street South of 18th												
A Street North of Bryan		N/A			N/A			N/A			N/A	
A Street South of Bryan												
East Antioch Station												
Hillcrest South of Larkspur	1050	0.55	A	1,070	0.56	A						
Hillcrest North of Larkspur	1,650	0.87	D	1,670	0.88	D		N/A			N/A	
Hillcrest South of 18th	620	0.33	A	640	0.34	A						

TABLE 4.7-3

Summary of Volumes and Levels of Service By Alternative (Continued)

	8/b/		
	Vol.	V/C	LOS
Downtown Concord/a/			
Port Chicago-East-Park/Clayton		N/A	
Oakland/Clayton/a/			
North Concord Station			
Port Chicago/Olivera Road		N/A	
West Pittsburg Station			
Bailey North of W. Leland			
Bailey South of Canal			
Bailey South of Willow Pass		N/A	
Willow Pass East of Port Chicago			
Willow Pass West of Bailey			
Pittsburg Station/c/			
Railroad South of Leland			
Railroad North of Bliss			
Railroad on Overpass			
Railroad North of California			
Harbor South of Leland			
Harbor North of Leland			
Bliss East of Railroad/d/			
Power West of Railroad		N/A	
Central West of Solari/e/			
Solari North of Central/e/			
California East of Harbor			
California West of Harbor			
E. Leland East of Harbor			
E. Leland West of Harbor			
E. Leland West of Railroad			
West Antioch Station			
Somersville South of Delta Fair	1,140	0.60	A
Somersville North of Delta Fair	2,010	1.06	F
Somersville South of Century	1,530	0.81	D
Somersville North of Century	1,010	0.53	A
Somersville South of 10th	790	0.44	A
A Street Station			
A Street South of 18th			
A Street North of Bryan		N/A	
A Street South of Bryan			
East Antioch Station			
Hillcrest South of Larkspur			
Hillcrest North of Larkspur		N/A	
Hillcrest South of 18th			

TABLE 4.7-3 (Continued)

/a/ Levels of Service shown are for intersections, all other volumes and Levels of Service shown are for the roadway segments specified.

/b/ Only impacts at the end-of-line stations are shown for the shorter guideway alternatives because the traffic at the intermediate stations would be identical to that of the primary alternatives.

/c/ Assumes station located on Power Avenue unless noted.

/d/ Station located on Bliss Street.

/e/ Station located on Central Avenue.

2. As the number of vehicle trips associated with access to each of the LRT stations along the Southern Pacific Railroad would be small, the additional traffic assigned to each roadway segment adjacent to the LRT stations would be small. The differences in the vehicle access trips shown in Table 4.7-2 disappeared when the vehicle access trips were assigned to each roadway segment and then the total numbers of vehicles were rounded off.

As vehicular volumes projected to be traveling to transit stations or park-and-ride lots would be small in relation to the projected future background traffic, changes in Levels of Service between alternatives would be very small. Most changes in Level of Service categories would occur when a relatively small volume would be added to or subtracted from a V/C ratio near a Level of Service threshold. This kind of change does not indicate a significant change in Level of Service, but is a result of how Level of Service categories are derived from V/C ratios. Each of the alternatives is discussed in more detail below.

Alternative 1 (No Build)

With the No-Build Alternative, the greatest impacts on operating conditions of intersections would occur near the downtown Concord BART station. MTC projects that the total number of entries and exits at the Concord BART Station will increase approximately 70 percent from 11,325 in 1980 to 19,200 in the year 2000. The Port Chicago/Olivera intersection near the North Concord park-and-ride lot is projected to operate at LOS D. In downtown Concord, the Port Chicago-East-Park/Clayton intersection would operate at LOS D and the Oakland/Clayton intersection would operate at LOS E. The latter Level of Service would be unacceptable to the City of Concord, because by City Ordinance, intersections which operate at LOS E or worse must be mitigated before a project is approved.

Alternative 2 (TSM)

The impacts of the TSM Alternative would essentially be the same as for the No-Build Alternative because the number of auto access trips would be essentially the same. The critical road link and intersection Levels of Service would remain the same as discussed above.

Alternative 3 (Busway/HOV Lanes)

The Bus/HOV Lane Alternatives would increase the use of the park-and-ride lots. However, the increase in volumes of vehicles arriving at or departing from the lots would not be great enough to change any of the Levels of Service projected for the first two alternatives. Conditions at the downtown Concord intersections, however, would improve because fewer persons would be driving to the Concord BART station. As the Level of Service at the Oakland/Clayton intersection would improve from an E to D, no mitigation would be required. This would be a significant improvement over the conditions projected for the first two alternatives. The Port Chicago/Olivera intersection would operate at LOS D.

This alternative includes direct access via exclusive on- and off-ramps from the local arterial to/from the HOV lanes at the Bailey Road/State Route 4 and Railroad Avenue/State Route 4 interchanges, essentially adding intersections with Bailey and Railroad Avenues into the middle of the respective interchanges. The potential conflicts between vehicles turning to and from the HOV lane ramps, vehicles turning to and from the regular freeway ramps, and vehicles turning to and from the frontage roads at Railroad Avenue could create a very confusing and congested condition. Due to the short separation between intersections, it would be difficult to coordinate the signals or provide sufficient turn-lane lengths at each of these locations. Providing direct access to the HOV lanes via fly-over ramps from the park-and-ride lot would eliminate many of these potential problems.

Alternatives 4 and 5 (LRT)

The impacts of the LRT Alternatives on intersections would be similar to those projected for the first three alternatives (Alternatives 1 through 3A). At the Concord intersections, the level of service would be C at the Port Chicago/Clayton intersection, improving from a D for previous alternatives. The level of service would remain D at the Oakland/Clayton and Port Chicago/Olivera intersections.

LRT Alternatives 4 and 5 would include two at-grade crossings, both in Concord. The first would be located at North Sixth Street and Port Chicago Highway. The LRT track would cross North Sixth Street on the eastside of Port Chicago Highway. This intersection is signalized, traffic volumes are low, and North Sixth Street provides access to a residential area. The second at-grade crossing would be across Olivera Road on the east leg of the Port Chicago intersection. This intersection is signalized.

The LRT tracks would be on aerial structures from the BART station northeast through downtown Concord across Clayton Road, Sinclair Avenue, Concord Boulevard, Willow Pass Road, and Salvio Street. The LRT tracks would then transition to at-grade on the east side of Port Chicago Highway north of Mount Diablo Hospital.

Daily vehicle volumes on Clayton Road between Oakland and Park are 26,000 today and are projected to increase to 36,000. The congested conditions at intersections through this area would require a grade separation at Clayton Road. Grade separation on Port Chicago Highway from Salvio to north of Mount Diablo Hospital would also be required because of restricted rights-of-way. An at-grade design in this location would require too much right-of-way which would either reduce capacity on Port Chicago Highway or require the purchase of homes.

North and east of the North Concord/Martinez station, the LRT tracks would not cross any other intersections at-grade. The tracks would be in the median of State Route 4 to the end-of-line station with Alternative 4, or to Willow Pass Road East with Alternative 5. With the SPTC alignment, the LRT would follow and cross Willow Pass Road East on aerial structure. The tracks would then be along the SPTC railroad tracks where the existing at-grade crossing at Railroad Avenue has been replaced with a grade separation. At Loveridge Road, the other railroad grade crossing, the LRT tracks would cross on an aerial structure to separate the LRT tracks from railroad sidings. (Somersville Road is planned to be lowered under the railroad tracks.)

With proposed peak-hour headways, LRT trains would cross intersections eight times per hour in each direction. At-grade crossings create potential for increases in accidents at these intersections resulting from vehicles and pedestrians crossing the intersection when a train would cross.

At the Olivera Road intersection, crossing trains could interrupt traffic operations and could reduce capacities if passage of the LRT trains were not coordinated with the north/south traffic movement. The LRT trains may experience delay if they were required to wait for the north/south movement. The actual operations of the intersection would have to be studied in detail to minimize delay to the LRT operations and vehicular traffic. Any reduction in capacity at North 6th Street would not significantly affect the intersection's operations, as North 6th Street is projected to serve low traffic volumes. For both intersections, all traffic movements not involving the east leg of the intersection would not be impacted by the LRT crossing because the tracks would be located on the eastside.

Alternative 6 (BART to North Concord/Martinez)

Operational impacts of the BART to North Concord/Martinez Alternative on non-Concord intersections would be the same as with the No-Build or TSM Alternatives. Operational impacts on Concord intersections would be reduced. The Port Chicago-East-Park/Clayton intersection would operate at Level of Service C, and the Oakland/Clayton intersection would operate at Level of Service D. Both intersections would have improved Levels of Service by having fewer vehicles traveling to the Concord BART station, because many of those vehicles would be headed instead to the North Concord/Martinez station.

Peak-hour traffic volumes would increase significantly at the on- and off-ramps connecting Port Chicago Highway and State Route 4, when comparing the No-Build and TSM Alternatives with this alternative. As many as 1,300 additional vehicles would be using the eastbound on-ramp in the p.m. peak hour than would be using that ramp with the No-Build or TSM Alternatives, assuming that most vehicle access trips from east of Concord used State Route 242 to reach the Concord BART station.

Alternative 7 (BART to East Antioch)

Operational impacts of the BART to East Antioch Alternative would be the same for non-Concord roadways as with previous alternatives. Concord intersections would experience the same impacts as with the North Concord BART Alternative, except the Level of Service at the Oakland/Clayton intersection would improve to C.

Alternative 7A (BART to West Pittsburg)

Traffic in the vicinity of an end-of-line BART station near Bailey Road would increase because of the additional trips that would be attracted to the station from points further east. The p.m. peak-hour vehicle volumes attracted to this location would increase by approximately 870 vehicles from the TSM alternative.

The Level of Service designation on Bailey Road between Leland Road and State Route 4 would be reduced from D with the TSM Alternative to E. The Level of Service along Bailey Road north of State Route 4 and Willow Pass Road would change from C to D due to the additional traffic using these roadways to get to the potential BART end-of-line station. Other roadlinks would maintain the same Level of Service designation.

The entrance to the BART station approximately 100 feet from the eastbound off-ramp should be restricted to right turns in and out. The signalized intersection at Bailey Road and Leland Road should be striped for two left-turn lanes and two through lanes on the west leg (requiring additional right-of-way), and the north leg should include an exclusive right-turn lane. The main entrance to the BART station should then be located on West Leland Road. The westbound State Route 4 off-ramp may need dual left-turn lanes to accommodate AM traffic movements.

Alternative 7B (BART to Pittsburg)

Traffic in the vicinity of the BART station near Railroad Avenue would increase from the TSM Alternative if the end of the BART line were located here. The traffic would be attributed to the additional trips that are projected to be attracted to this station from the Antioch area. P.M. peak-hour vehicle volumes at this location would increase by approximately 725 vehicles from the TSM Alternative.

The Level of Service designation on Railroad Avenue is projected to change from E to F in the vicinity of State Route 4 with the proposed BART station on the north side of State Route 4 at Power Avenue. The Level of Service designation on Power Avenue is estimated to fall from A to F. California Avenue will continue to operate at Level of Service F in the vicinity of the State Route 4 westbound off-ramp. Other roadways would operate at Level of Service D or better.

If the BART station were located off of Bliss Street, the traffic impacts on Power Avenue would be eliminated. The impact on Railroad Avenue traffic north of State Route 4 would be eliminated and shifted to Harbor Road between California Avenue and Bliss Street and onto Railroad Avenue between Bliss Street and State Route 4. Harbor Road is projected to operate at Level of Service A in the vicinity of State Route 4 and should be able to accommodate the traffic exiting State Route 4 westbound at California Avenue. (However, California Avenue would operate at Level of Service F.) The additional traffic on Bliss Street would reduce the Level of Service on that street from A to E.

An end-of-line BART station north of State Route 4 would require widening Railroad Avenue from four to six lanes between State Route 4 and Power Avenue, including the overpass. Power Avenue would also have to be widened from two to four lanes. The off-ramp from State Route 4 would have to be widened to two lanes, with the ramp's intersection with California Avenue signalized.

If the station were located south of State Route 4, the required widening of Railroad Avenue from four to six lanes in this area to accommodate "background" traffic would support BART traffic levels. Turn lanes along Bliss Street into the station would improve the levels of service to satisfactory levels. The BART station should be placed along Bliss Street to take advantage of the dual access points, Railroad Avenue and Harbor Road.

Alternatives 4A and 8 (LRT to West Antioch)

Traffic in the vicinity of the end-of-line LRT station near Somersville Road would increase if the end of the LRT line were located here. The vehicle volumes from further east attracted to this station would increase by approximately 500 vehicles from the TSM Alternative.

The additional trips would reduce the peak-hour level of service on Somersville Road from D to E between Century Boulevard and State Route 4. Somersville Road should be widened from four to six lanes in the vicinity of State Route 4 and Century Boulevard.

The impacts on other intersections would be identical to those presented for the other LRT Alternatives (4 and 5). Alternative 4A would follow the same vertical and horizontal alignments as Alternative 4 in Concord and West Pittsburg, while Alternative 8 would the LRT service start at the North Concord/Martinez station.

Mitigation Measures

The additional vehicle access trips at some intersections associated with some of the alternatives would require mitigation in order to have the intersections operate at Level of Service D. Specific mitigation measures proposed for each alternative are presented below.

Alternative 1 (No-Build) and 2 (TSM)

The intersection of Oakland Avenue and Clayton Road in downtown Concord would experience the greatest traffic impacts of the intersections studied, and would require mitigation because the projected level of service (LOS) would be E. The mitigations required to support joint development of the BART station area included a pedestrian overpass across Clayton Road, and loss of BART right-of-way on Clayton Road (12 feet) for the right-turn lane and on Oakland Avenue (up to 24 feet) for the approach lane configuration. (These changes will impact BART significantly because the loss of right-of-way will result in the loss of parking capacity, and the pedestrian overpass would be expensive.) In addition to those mitigations, additional mitigation measures are required, but there are no other physical mitigation measures that are practical to implement. If access to the shopping center across the street could be constrained to right turns in and out, the level of service would improve to D with the mitigation measures considered part of the BART station joint development proposal. The City of Concord has attempted to get the owners of the shopping center to reduce access at this location, but has made no progress in getting the owners to agree.

The Level of Service at the intersections in downtown Concord with the other alternatives would be satisfactory if all the mitigations developed as part of the Concord BART Joint Development analysis were implemented. The extension of BART service east to at least North Concord would reduce vehicle access trips making left turns from Oakland Avenue significantly, which would reduce the left-turn lane requirements from 2 to 1, and the right-of-way required from BART by 12 feet.

Alternatives 2 (TSM), 3 and 3A (HOV), 4 and 7 (LRT and BART to Antioch)

A signal would be required at the Railroad Avenue/Power Avenue intersection. The new signal should be interconnected with existing Railroad Avenue signals. The signal should be incorporated into the widening of Railroad Avenue required to accommodate background traffic growth. (Poor operating conditions would continue in this area because of the close distance between signalized intersections.)

The westbound off-ramp to Railroad Avenue via California Avenue would have to be widened to two lanes. The intersection of that off-ramp with California Avenue would be signalized.

Alternative 5 (LRT to Antioch via SPTC)

Central Avenue between Solari Street and Railroad Avenue should be widened to accommodate a total of 4 lanes with turn pockets.

Alternative 6 (BART to North Concord/Martinez)

To accommodate the vehicles destined to the North Concord/Martinez BART station, the following improvements would be needed:

- A traffic signal on Port Chicago Highway at the entrance to the BART park-and-ride lot.

- Dual left-turn lanes from southbound Port Chicago Highway onto the roadway leading into the BART station.

Railroad Avenue Station Location

In this analysis, it was assumed that the Pittsburg station would be located along Power Avenue. An alternative location would be on the south side of State Route 4 on Bliss Street between Harbor Street and Railroad Avenue. If the station were located along Bliss Street, there would be no traffic impact on Power Avenue and the impact on Railroad Avenue north of State Route 4 would be reduced. As most of the potential passengers are projected to live on the south side of State Route 4, traffic impacts would be reduced and access would be better for a station on Bliss Street rather than Power Street. If the Pittsburg BART station is located off of Bliss Street, a signal would be required at the Railroad Avenue/Bliss Street intersection.

4.7.8 PARKING IMPACTS

Existing Conditions

The downtown Concord BART station has a parking supply of 1,912 spaces which are consistently fully occupied by 7:30 a.m. Monday through Friday. BART has estimated that up to 430 additional vehicles are parked in off-site locations, primarily in unrestricted curb parking along Mesa and Laguna Streets, and in paid parking in the adjacent Bank of America garage. The neighborhoods to the south are protected from overflow parking from the BART station by a residential permit

parking district that restricts parking without a permit to four hours. Parking in other areas around the station is restricted from use by BART patrons either by time limits or, in the case of private parking lots, by signs and towing.

The North Concord/Martinez BART park-and-ride lot on Port Chicago Highway is served by the BART Route Express Bus. That lot has 530 parking spaces which are typically empty.

There are also existing park-and-ride lots along State Route 4 at Bailey Road and Hillcrest Avenue. Parking supplies are adequate to meet existing demands associated with BART Express Bus service and carpooling.

Future Conditions

Maximum parking supplies for each alternative have been established either by experience at existing BART stations or by available land area at the potential station sites. The Concord BART station would have 3,775 parking spaces for the first four alternatives. For the remaining alternatives, the maximum supply would be 2,575 spaces. The maximum capacity of all other stations would be approximately 2,500 spaces by BART policy, except at the LRT station located on A Street. That station would have a much lower parking capacity due to restrictions on available land area, and it could accommodate approximately 350 spaces.

Future parking requirements are presented in Table 4.7-4.

Alternative 1 (No-Build)

With the No-Build Alternative, the downtown Concord station would have a supply of 3,775 on-site spaces plus approximately 430 off-site spaces serving overflow demands (based upon existing conditions). Thus, the demand projected of 4,930 spaces would produce a shortage of 725 spaces. The traffic volumes generated and used in the traffic impact analysis represent a worse case analysis, because they do not assume parking restraints. If additional parking spaces were not added to meet the demand projected, the restrictions on use of other parking supplies in the area would force those potential riders to switch from BART to other modes. That could reduce the traffic impacts in the immediate vicinity of the BART station, but would increase regional auto travel. (These conclusions would also apply to all other cases described below where parking demand is projected to exceed parking supply.)

There would be enough parking at each of the park-and-ride stations to meet projected demands. Some of the excess parking demand at the Concord station could be reduced with additional BART express bus service.

Alternative 2 (TSM)

With the TSM Alternative, the downtown Concord BART station would experience a similar shortage as discussed above. The parking supply would again be 4,205 spaces, including 430 off-site spaces. The demand for 4,810 spaces would produce a shortage of 605 spaces. This shortage would probably constrain BART's ridership below the level forecast for this analysis. There would be no parking shortages at any of the BART express bus park-and-ride lots.

TABLE 4.7-4

PARKING SPACE REQUIREMENTS AT DIFFERENT STATIONS OR PARK-AND-RIDE LOTS ALONG THE CORRIDOR /a/

	YEAR 2000 ALTERNATIVES											
BART or LRT Station, or Bus Park-n-Ride lots	1	2	3	3A	4	4A	5	6	7	7A	7B	8
Concord /b/	4,930	4,810	4,140	4,140	3,920	3,920	3,920	2,860	2,860	2,860	2,860	3,280
M.D. Hospital	----	60	----	----	0 /c/	0 /c/	0 /c/	----	----	----	----	----
North Concord	10	40	----	----	360	360	350	3,040	2,020	2,020	2,020	2,040
West Pittsburg	30	----	140	140	200	200	200	10	280	1,970	280	150
Pittsburg	----	----	300	1,260	300	300	290	----	340	----	1,850	220
West Antioch	----	----	410	----	490	1,220	490	----	640	----	----	920
Antioch (A-Street) /d/	----	----	----	----	----	----	0	----	----	----	----	----
East Antioch	210	290	610	----	730	----	720	220	960	----	----	----

/a/ The parking demand is based on the auto access output from the MTC mode-of-arrival model.

/b/ The maximum parking supply at the Concord Park-and-Ride lot is established by the available land area and is restricted to accomodate a maximum of 3775 spaces for the No Action, TSM and Bus/HOV Alternatives, and 2575 spaces for the rail extension alternatives.

/c/ The required parking spaces for this LRT station would be zero, because no auto access trips were assigned to this station.

/d/ The required parking spaces for this LRT station would be zero, because no auto access trips were assigned to this station, because MTC coded this network alternative to not have parking at this station. The costs estimate include provision of 350 spaces. Parking demand at this station would reduce some of the parking demand at the two adjacent stations.

Source : Barton - Aschman Associates ,Inc..

Alternative 3 (HOV to Antioch)

With the Busway/HOV Lane Alternative, the downtown Concord station would have a supply of 4,205 spaces, including the 430 off-site spaces. The demand for 4,140 parking spaces would produce an excess of 65 spaces. Parking demand and supply would be basically balanced, so that the ridership forecast for BART in this alternative could be achieved. There would be no parking shortages at any of the park-and-ride lots.

Alternative 3A (HOV to Pittsburg)

This alternative would produce an increase in parking demand at the Pittsburg park-and-ride lot, but there would be adequate area to provide the required parking supply. Parking supply and demand at the Concord BART station would be basically balanced.

Alternatives 4 and 4A (LRT to East Antioch and West Antioch)

With the LRT along State Route 4 Alternatives the downtown Concord station would have an on-site parking supply of 2,575 parking spaces. Adding the off-site supply of 430 spaces would yield a total of 3,005 spaces. The demand for 3,920 spaces would produce a shortage of 915 spaces. Ridership on BART would be constrained to not reach the level forecast by MTC, because of that lack of access, unless additional parking spaces were added.

There would be no parking shortages at any of the other LRT stations. With the shorter guideway alternative ending at the West Antioch station, the demand for parking there would increase from 490 with the full-length alternative to 1,210 spaces. As there would be adequate room to accommodate up to 2,500 spaces at this station, sufficient parking could be provided to meet demand.

Alternative 5 (LRT to Antioch via SPTC)

With the LRT along SPTC Railroad Alternative, the downtown Concord BART/LRT station would have a total of 3,005 parking spaces available. The demand projected of 3,920 spaces would yield a shortfall of 915 spaces. That lack of parking supply would constrain ridership on BART below the level forecast. Sufficient parking would be available at all other LRT stations and the existing park-and-ride lots along State Route 4.

Alternative 6 (BART to North Concord/Martinez)

With the BART to North Concord/Martinez Alternative, the downtown Concord station would exhibit a demand for 2,860 spaces. The supply, as with the LRT alternatives, would be approximately 3,000 spaces, including the 430 off-site spaces existing today. Essentially, supply and demand would be balanced, with a possible excess of 140 spaces during the peak period.

The demand for 3,040 spaces at the North Concord/Martinez station would exceed the proposed maximum supply level by 540 spaces.

Alternative 7 (BART to Antioch)

With the BART to East Antioch Alternative, the impacts at the downtown Concord station would be the same as for the BART to North Concord/Martinez Alternative. Extending BART past North Concord/Martinez would reduce the parking requirement at the Concord station so that parking demand could be satisfied with the proposed on-site supply. There would be adequate parking supplies at each of the other BART stations to meet project parking demands.

Alternatives 7A and 7B (BART to West Pittsburg and Pittsburg)

These alternatives would require increased parking supplies at the end-of-line stations, but those parking requirements would be less than potential supply.

Alternative 8 (BART to North Concord/Martinez; LRT to West Antioch)

At the Concord station the parking demand projected of 3,280 would exceed the supply provided by 275 spaces.

<u>**Possible Mitigation Measures**</u>

To provide a balance between projected parking demand and supply would require implementation of the following actions:

1. Provide additional parking at the Concord station, as follows:

Alternative 1 (No Build)	-- A total of 4,930 parking spaces (an increase of 725 spaces above the supply assumed).
Alternative 2 (TSM)	-- A total of 4,810 parking spaces (an increase of 605 spaces above the supply assumed).
Alternatives 4, 4A & 5 (LRT)	-- A total of 3,920 parking spaces (an increase of 915 spaces above the supply assumed).
Alternative 8 (BART to North Concord/ Martinez; LRT to W. Antioch)	-- A total of 3,280 parking spaces (an increase of 275 spaces above the supply assumed).

2. Provide additional parking at the North Concord/Martinez Station:

Alternative 6 (BART to North Concord/ Martinez)	-- A total of 3,040 parking spaces (an increase of 540 above the supply assumed).

3. Provide at least the level of BART Express buses defined for all the alternatives.

4.8 TRAVEL TIME SAVINGS

The cost-effectiveness index used by the Urban Mass Transportation Administration to evaluate if preliminary engineering funds should be awarded includes the following components:

in the numerator	-	incremental annualized capital costs, operating costs, and dollar value of travel time savings
in the denominator	-	incremental new riders.

All of these incremental components are measured for each alternative compared to the TSM Alternative.

This section presents the differences in travel times, as these would be the primary transportation benefits to users of the alternatives. The numbers of incremental riders were presented in the section describing linked transit trips. The differences in travel times are shown in Table 4.8-1.

The BART extension alternatives are projected to create the greatest savings in travel time because the transit riders assigned to the TSM Alternative would spend less time traveling to the Concord BART station in a private vehicle or BART Express bus than they would in traveling to a station further east. The BART to East Antioch Alternative would create the greatest reduction in travel time savings because that alternative would provide the shortest access distances and times to the BART riders in the corridor. Shorter guideway alternatives would provide smaller travel time savings than the full corridor alternatives. The LRT alternatives would provide smaller travel time savings than the Bus/HOV alternative because the bus routes would provide shorter access distances and times in the residential neighborhoods. Two transfers, one to get on the LRT trains and another to transfer from LRT to BART trains would be required with the LRT alternatives. The extension of BART to North Concord/Martinez, with its reduction in access and parking time, would also create greater traveltime savings than the LRT alternatives.

TABLE 4.8-1

DAILY TRAVEL TIME SAVINGS (HOURS) BETWEEN EACH ALTERNATIVE AND THE TSM ALTERNATIVE /a/

YEAR 2000
ALTERNATIVES

	1	3	3A	4	4A	5	6	7	7A	7B	8
Travel Time Savings	-700	1,050	950	850	900	900	1,200	2,650	2,100	2,350	2,150

/a/ The Travel Time Savings are calculated by taking the difference in riders between each alternative and the TSM Alternative based on the trips that are produced and attracted in Contra Costa County (MTC Superdistricts 20,21,22,23,24,25), but excluding the trips produced in Contra Costa County that are attracted by the Fremont/Southbay Corridor (MTC Superdistricts 8,9,10,11,12,13,14)

Source : Barton-Aschman Associates, UEVAL reports for the Alternatives.

SECTION 5

ENVIRONMENTAL CONSEQUENCES

5.1 LAND USE AND RELOCATIONS

Following is a description of corridor-level impacts, station-level impacts, right-of-way acquisitions required, and relocation effects. The corridor-level impacts describe the land use impacts along the alternative alignments, while the station-level impacts describe land use impacts on and adjacent to the alternative station sites. The rights-of-way that need to be acquired for each alternative and the relocations that would be required from these acquisitions are also described. Mitigation measures are also recommended for each type of impact (corridor- and station-level impacts, and right-of-way acquisition and relocation impacts).

5.1.1 CONSISTENCY WITH LOCAL PLANS AND POLICIES

Corridor-Level

The cities of Concord, Pittsburg, and Antioch and Contra Costa County have addressed issues pertaining to the development of the region's transportation system within local and regional plans and policies. The transportation alternatives proposed for the Pittsburg-Antioch Corridor primarily follow established and planned transportation facilities such as Concord Avenue, Port Chicago Highway, State Route 242, State Route 4, Willow Pass Road, and the SPTC railroad.

Alternative 1 (No Build), 2 (TSM), 3 (HOV to Antioch), and 3A (HOV to Pittsburg) would use existing and planned transportation corridors, that are identified on existing cities and county plans along the corridor. Therefore, the implementation of these nonrail alternatives would be consistent with local and regional plans and policies.

Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would result in a few inconsistencies with local plans. In downtown Concord, these alternatives would require an amendment to the City of Concord Land Use and Circulation plans to permit an extension of an LRT or BART line from the existing Concord Station to Port Chicago Highway. Currently, the area along the planned alignments between the existing Concord Station and Port Chicago Highway is designated for office and commercial uses.

Alternative 5 (LRT to Antioch via SPTC) would also require the Contra Costa County plans for West Pittsburg to be amended in two areas. One area is located immediately adjacent to and west of Willow Pass Road between State Route 4 and Port Chicago Highway. This area is currently designated for high density single family uses. The second area is located north of Willow Pass Road, south of the SPTC line, and west of Bailey Road. This area is currently designated for industrial uses.

The remaining segments of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 are within established transportation systems.

Station-Level

Alternatives 3 and 3A, and Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 propose stations (includes park-and-ride facilities) along the Pittsburg-Antioch Corridor. Alternative 1 (No Build) does not propose stations and/or park-and-ride facilities along the corridor. Alternatives 2, 3, 3A, 4, 4A, 5, 6, 7, 7A, 7B, and 8 propose stations and/or park-and-ride facilities that range in size from 1.7 to 29 acres. The station proposed with the smallest area for parking and bus transferring activities is for Alternative 2 (TSM) at Station F in the City of Pittsburg while the station proposed with the largest area is for Alternatives 3, 3A, 4, 4A, 7, 7B, and 8 at Station F off of Railroad Avenue in the City of Pittsburg. The general plan land uses that are currently designated for each of the stations are shown in Table 3.1-1 in Section 3.1. All proposed station areas are designated for nonresidential uses. The proposed stations, which consist of parking and bus transferring activities, would be consistent with existing general plan designations for all the proposed stations.

5.1.2 CORRIDOR-LEVEL LAND USES

Impacts

The potential for land use impacts has been evaluated related to direct changes in existing and planned land uses caused by implementation of each alternative and indirect impacts due to proximity to alignments or stations. Major regional land use changes would not be expected along the alternative alignments because they follow established transportation facilities, such as Concord Avenue, State Route 242, Port Chicago Highway, Willow Pass Road, State Route 4, and/or the SPTC line. (Refer to Section 5.2 for discussion of indirect land use and development effects.)

Alternatives 1 (No Build) and 2 (TSM) would not result in land use impacts along the transit route because no development would occur and no direct changes in land uses would be required. Also, land uses adjacent to the alternative alignments would not be affected. Alternative 2 could result in a decrease in traffic volumes along the corridor, thereby causing a potential minor reduction in noise and air quality impacts on adjacent land uses (see more detailed discussions in Section 5.11 for noise effects and Section 5.12 for air quality impacts).

Alternatives 3 and 3A (HOV to Antioch, HOV to Pittsburg) would utilize Concord Avenue in the City of Concord, State Route 242, and State Route 4. The City of Concord is independently planning to widen Concord Avenue between Salvio Street and the northbound on-ramp of State Route 242 by one lane in each direction. This roadway widening is planned to accommodate existing and future traffic volumes in this area; however, the roadway widening is not required to accommodate the Alternatives 3 and 3A. State Route 242 and State Route 4 would be improved under both alternatives by adding two additional lanes (one in each direction) to the existing four lanes. On State Route 242 the additional lanes would be free flow, whereas on State Route 4 lanes would be used exclusively as a busway/HOV lane. The additional lanes would be installed in the existing and/or planned median of both highways. State Route 4 is currently planned to be widened and/or realigned between Willow Pass Road (west) and Bailey Road in Pittsburg; however, the widening and/or realignment is not part of these alternatives. Both of these alternatives would require some right-of-way acquisitions along State Route 4. The

majority of the right-of-way needs for the implementation of Alternatives 3 and 3A include vacant land. However, there are some existing residential, commercial, and industrial uses that would be adversely affected due to the acquisitions (see Tables 5.1-2 and 5.1-3 in Sections 5.1.4 and 5.1.5, respectively for the amount of land, number of structures, and the use of the structures that require acquisition). Except for the uses that would be acquired to provide additional State Route 4 right-of-way, the uses adjacent to the alignment of these alternatives would not be affected. Adjacent uses could experience a decrease in potential traffic volumes along the transit route and experience a reduction in potential noise and air quality effects (see more detailed discussions in Section 5.11 for noise impacts and Section 5.12 for air quality impacts).

Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would result in a few direct impacts, including changes in existing and planned land uses, and several indirect impacts on uses surrounding the alternative alignment. A majority of the alignment of the rail alternatives would use Port Chicago Highway, State Route 4, and/or the Southern Pacific Railroad. Since these roadways and railway are existing facilities, the addition of a transit alternative within the existing rights-of-way would not represent a change in land use designation. Some acquisitions of rights-of-way adjacent to Port Chicago Highway, State Route 4, and the Southern Pacific Railroad would be acquired under Alternatives 4, 4A, 5, 6, 7A, 7B, and 8. These acquisitions would affect existing residential, commercial, and industrial uses (see Section 5.1.3 for the number of structures affected and their land use). In addition, the LRT maintenance yard site in Pittsburg would also need to be acquired for Alternatives 4A and 8.

In downtown Concord, Alternatives 4, 4A, and 5 (LRT) would result in less changes in land uses than with Alternatives 6, 7, 7A, 7B, and 8 (BART) because the BART alternatives require a wider turning radius from the existing Concord Station to Port Chicago Highway. The LRT alternatives would directly affect and require the removal of the following land uses between the existing Concord Station and Port Chicago Highway:

- Vehicle storage northwest of the Clayton Road/East Street intersection.
- A small portion of the western boundary of the Longs Drug Store parking lot between Clayton Road and Sinclair Avenue.
- Office buildings and residences between Sinclair Avenue and Concord Boulevard.
- A portion of the Safeway parking lot (40-foot maximum width) between Concord Boulevard and Willow Pass Road.
- Office buildings between Willow Pass Road and Salvio Street.

The BART alternatives would directly affect and require the removal of the following uses between the existing Concord Station and Port Chicago Highway:

- A portion of the Longs Drug Store parking lot (40-foot maximum width) between Clayton Road and Sinclair Avenue.

- Office buildings and residences between Sinclair Avenue and Concord Boulevard.
- A portion of the Safeway parking lot (40-foot maximum width) between Concord Boulevard and Willow Pass Road.
- Office buildings and residences between Willow Pass Road and Salvio Street.

Pending detailed engineering and right-of-way determinations, entire parcels may be acquired for the BART alternatives. If so, additional relocations may be required.

Land uses that are adjacent to the LRT and BART alternative alignments in downtown Concord that would be affected include office and commercial uses. The alternatives would result in an aerial structure that would reduce the aesthetics and views in downtown Concord. However, since office and commercial uses are not as visually sensitive as residential uses, significant aesthetic and visual effects are not expected (see Section 5.4 for visual and aesthetic impacts).

BART Alternatives 6, 7, 7A, 7B, and 8 would also affect six residences as these alignments swing into Station C (North Concord/Martinez). These residences would require relocation as described in Section 5.1.5.

Alternative 5 (LRT to Antioch via SPTC) would also affect land uses in two areas of West Pittsburg. Both areas are currently vacant; therefore, no land use impacts would occur to existing uses. However, future land uses planned for this area would require a change to a transportation designation. One area is located immediately adjacent to and west of Willow Pass Road between State Route 4 and Port Chicago Highway. This area is planned for high density single family uses. The potential amount of future residential development in this area would be reduced due to the required land use change for the rail line and also for adequate buffers from the rail line to reduce potential noise, aesthetic, light, and glare impacts. The second area is located north of Willow Pass Road, south of the SPTC line, and west of Bailey Road in West Pittsburg. The amount of planned future industrial development would be reduced due to the required land use change for the rail line and also for adequate buffers from the rail line. This area is also the site of a proposed LRT station (a detailed station impact discussion is presented in Section 5.1.3).

Alternatives 7, 7A, and 7B would also require a south yard lead. There would be no right-of-way acquisition or displacement of existing uses for construction of the south yard lead. The lead track would be located entirely within the property and facilities of the BART maintenance facility and yard. Therefore, no direct land use impacts would occur as a result of the lead track implementation.

The closest sensitive surrounding land uses are single family residences to the southeast of the south yard lead alignment (approximately 200 feet at their closest point). Because the south yard lead would be at-grade within an existing rail yard, and sufficient setback exists between the tract and existing homes, no land use impacts would occur due to its construction and operation.

In summary, the implementation of Alternatives 1 and 2 would not affect existing or planned land uses along the Pittsburg-Antioch Corridor. Except for the required right-of-way acquisitions along State Route 4, Alternatives 3 and 3A would not affect existing or planned land uses along the corridor (see Section 5.1.5 for relocation impacts). Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would utilize existing and planned transportation facility rights-of-way in most areas. The alternative alignments would also extend through parking lots, storage areas, shopping center parking lots, residences, and office buildings in downtown Concord. These existing uses in downtown Concord would be significantly affected due to a required removal of existing developments. BART Alternatives 6, 7, 7A, 7B, and 9 would also affect six residences as these alignments swing into Station C (North Concord/Martinez). These residences would require relocation. Alternative 5 (LRT to Antioch via SPTC) would also extend through two vacant areas that are planned for residential and industrial uses. Therefore, planned uses in these areas would be affected significantly, requiring a change in future land use designations in local plans.

Mitigation Measures

Alternatives 4, 4A, 5, 6, 7A, 7B, and 8 should implement the following measures to reduce potential land use impacts to a level of insignificance.

1. Amendments to the City of Concord General Plan Land Use Element and Circulation Element may be required and requested for the extension of the rail line from the existing Concord BART Station to Port Chicago Highway.

2. The relocation and assistance programs described in Section 5.1.4 shall be implemented to reduce the impact of displacing businesses and residences.

Alternative 5 (LRT to Antioch via SPTC) should also implement the following measure to reduce potential land use impacts.

3. Amendment to the West Pittsburg General Plan Land Use Element and Circulation Element shall be requested for the alignment of the rail line from State Route 4 to Willow Pass Road and from Willow Pass Road to the SPTC line.

5.1.3 STATION-LEVEL LAND USES

Impacts

The majority of the land use impacts along the Pittsburg-Antioch Corridor are expected to be concentrated at the station locations due to displacement of land uses for the station's parking and bus transfer facilities.

Alternatives 1 and 2 would not result in the addition of any stations or park- and-ride lots. The existing park-and-ride facilities would continue to be used and no additional land use impacts would occur from Alternatives 1 or 2. Alternative 3 (HOV to Antioch) would result in the acquisition of land for park- and-ride facilities; therefore, businesses would be displaced and land uses would be modified. Land use impacts associated with the alternative station sites along State Route 4 would be similar for Alternatives 3 and 3A and Alternatives 4, 4A, 7, 7A, 7B, and 8. Alternative 5 (LRT to Antioch via SPTC) would result in station land use impacts along the SPTC line. Land use impacts associated with the stations proposed in the City of Concord and the existing Concord BART Station would be similar for Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8. Table 5.1-1 illustrates the stations that would be constructed for each alternative. Following is a discussion of the land use impacts associated with the implementation of the proposed stations or park-and-ride lots.

Onsite Station Impacts

As shown in Table 3.1-1 in Section 3.1.4, none of the stations would require the relocation of residences, but construction of stations F, F (ALT), G, and J would require the removal of structures. Pittsburg Station F would require the removal of public facility uses including the California National Guard Armory and city, county, and school district offices. Pittsburg Station F (ALT) would require removal of several buildings located in an industrial park. Pittsburg Station G would require the removal of several commercial uses and a church. Antioch Station J would require the removal of only a few commercial and industrial uses. All the uses that will require removal would be significantly affected; however, relocation of these uses could reduce the significance of the land use impacts. The Pittsburg Stations H and I, and East Antioch Station K would require the removal of existing agricultural activities; however, each of these station sites are designated for future industrial uses. Therefore, no inconsistency with Pittsburg's or Antioch's general plans would result. The remaining alternative station sites are currently vacant or contain existing BART park-and-ride facilities.

A majority of the station sites are currently designated for commercial, industrial, or public facility uses in the existing cities and county general plans. The station activities such as parking and bus transferring would be consistent with these designated land uses. A large portion of West Pittsburg Station D is currently designated for residential uses in the Pittsburg General Plan and implementation of this station would significantly reduce potential residential development in this area and change the character of the area.

Station Impacts on Surrounding Uses

As shown in Table 3.1-1 in Section 3.1, residential, commercial, industrial, public facility, park, agriculture, and U.S. Naval Weapons Station uses are located adjacent to the alternative station sites. The most sensitive land use adjacent to the stations is residential. The other uses could be compatible with the parking and bus transferring activities associated with the alternative stations. Residential uses currently exist in the vicinity of each alternative station. Potential effects of the stations on adjacent residences include an increase in traffic, noise, light, and glare and a reduction in aesthetics. Stations that would result in the most substantial impact on adjacent residences include Stations D, E, F, and J.

TABLE 5.1-1

STATIONS PROPOSED FOR EACH ALTERNATIVE

Station	TRANSPORTATION ALTERNATIVES											
	1	2	3	3A	4	4A	5	6	7	7A	7B	8
A Concord					X	X	X					
B Mount Diablo Hospital					X	X	X					
C N. Concord/ Martinez		X			X	X	X	X	X	X	X	X
D Bailey Rd. W. Pittsburg			X	X	X	X			X	X	X	X
E Willow Pass SPTC W. Pittsburg							X					
F Railroad Ave. Pittsburg		X	X	X	X	X			X	X	X	X
F (Alt) Harbor St. Pittsburg			X		X	X			X			X
G Railroad Ave. Pittsburg							X					
H Somersville West Antioch		X	X		X	X			X		X	
I Standard Oil Avenue West Antioch							X					X
J Antioch							X					
K Hillcrest Avenue Antioch		X	X	X	X						X	

Source: Michael Brandman Associates, Inc. 1988.

Each of these stations have residences immediately adjacent and the residences are expected to experience an increase in light and glare due to lighting for the proposed station parking lots. Light and glare impacts could be reduced by designing the lighting systems to angle the light and prevent intruding illumination on adjacent residences.

Traffic and noise would also increase in the station areas. Stations D and F are adjacent to State Route 4; therefore, traffic would not travel through residential neighborhoods to access these stations. Traffic and noise would increase along Bailey Road adjacent to Station D and Railroad Avenue adjacent to Station F. Residential uses exist adjacent to Bailey Road and Railroad Avenue and could be affected by the increase in traffic and noise associated with station activities. Stations E and J are near the SPTC line and traffic accessing these stations from State Route 4 would require a longer travel distance. Traffic and noise would primarily increase on Willow Pass Road, Port Chicago Highway, and Bailey Road with the implementation of Station E. Residences along these major streets are not expected to be significantly affected by the increase in traffic due to Station E activities. Development of Station J would primarily increase traffic and noise along A Street and could affect residences located on A Street. (See more detailed discussions in Section 4 for traffic impacts and Section 5.11 for noise impacts.)

Station E is expected to result in the most substantial aesthetic impacts compared to the other alternative station sites for Station E. An at-grade rail line is proposed which would decrease the views of the existing residences located west of the station. These residences have backyard views into the station site and to the east. Views that would be lost are the existing onsite vacant land, the grazing activities east of the station site, portions of the Shell Oil industrial uses, and a partial view of Suisun Bay (see Section 5.4 for a more detailed analysis of aesthetic impacts).

In addition to potential affects of parking and bus transferring activities on adjacent land uses, potential onstreet parking adjacent to the stations by transit riders could occur. Except for Alternatives 4, 4A, and 5, all alternatives provide substantial amount of parking spaces at each station. In addition, except at Station B at Mt. Diablo Hospital, Alternatives 4, 4A, and 5 also provide a substantial amount of parking spaces at each station. Station B at Mt. Diablo Hospital provides bus transferring activities; however, no parking would be provided. Station B is proposed primarily for employees at Mt. Diablo Hospital and not for residents between Stations A and C. Because Alternatives 4, 4A, and 5 would also provide stations with parking facilities within 0.25 miles (Concord LRT Station) and 0.75 miles (North Concord/Martinez Station) of the Mt. Diablo Station, transit riders who would drive to a station in the City of Concord would not be significantly inconvenienced if the nearest station was Station B and they had to drive to the Concord LRT Station (Station A) or the North Concord/Martinez Station (Station C). There is currently a relatively small population that currently resides closer to Station B than Stations A or C. A majority of the transit riders who would drive to a station in the City of Concord currently resides closer to the Concord LRT Station or North Concord/Martinez Station. Station C is nearest to most of the North Concord residents and residents in the City of Martinez. Station A is nearest to residents south of Willow Pass Road which contains the majority of the city's population. Therefore, a relatively small population would be inconvenienced to drive to Stations A or C than Station B.

Mitigation Measures

1. The relocation and assistance programs described in Section 5.1.5 shall be implemented to reduce the impact of displacing businesses, public facilities, and residences.

2. Lighting systems shall be designed and installed at angles that prevent intruding illumination in the direction of existing light-sensitive land uses such as residences.

5.1.4 RIGHT-OF-WAY ACQUISITIONS REQUIRED

The transportation alternatives propose to use existing transportation system rights-of-way to the extent feasible. However, a majority of the alternatives will need to acquire additional rights-of-way adjacent to the existing transportation systems in order to adequately implement the alternatives. The HOV and rail alternatives would also require right-of-way for the proposed stations. Table 5.1-2 depicts the number of acres of land (not including residential acres) and residences that would be acquired in each area along the corridor and acquired for each alternative (see Exhibit 5.1-1 for location of areas 1 through 9). Areas 1 through 9 on Table 5.1-2 include right-of-way acquisitions along the corridor and at each station. The residences are separated from the total acres, because the right-of-way that would be required primarily include portions of residential backyards and, as a worst case, the entire residential use on the affected lot may be acquired. As shown on Table 5.1-2, Alternative 5 (LRT to Antioch via SPTC) would require the acquisition of more residences (44) along the corridor than any other alternative. All of the residences that would be acquired in this alternative are located in the City of Antioch. Alternative 7 (BART to Antioch) would result in the acquisition of more land than any other alternative.

5.1.5 RELOCATIONS

A majority of the transportation alternatives will require the relocation of businesses and residences to implement the proposed rail line alignments and stations. Table 5.1-3 depicts the number of structures by type of use that will require relocation. The structures that will require relocation are also identified by area along the alignment and by alternative (see Exhibit 5.1-1 for an index map of the areas along the alignments).

Implementation of Alternative 1 (No Build) would not require the acquisition of any right-of-way; therefore, no businesses or residences would require relocation. Implementation of Alternative 2 (TSM) would require acquisition of right-of-way for park-and-ride facilities which do not contain businesses or residences. Alternatives 3 and 3A, and Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would affect parcels with existing businesses and residences along the alignments and at the proposed station areas. These alternatives would require the relocation of the affected businesses and residences. As shown in Table 5.1-3, Alternative 5 (LRT to Antioch via SPTC) would require the relocation of more residences (44) than any other alternative. Alternative 5 (LRT to Antioch via SPTC) would also require the relocation of more businesses (32) than any other alternative. A majority of the businesses that would be relocated are in the City of Pittsburg at Station G at Railroad Avenue.

TABLE 5.1-2

REQUIRED RIGHT-OF-WAY ACQUISITIONS BY ALTERNATIVE

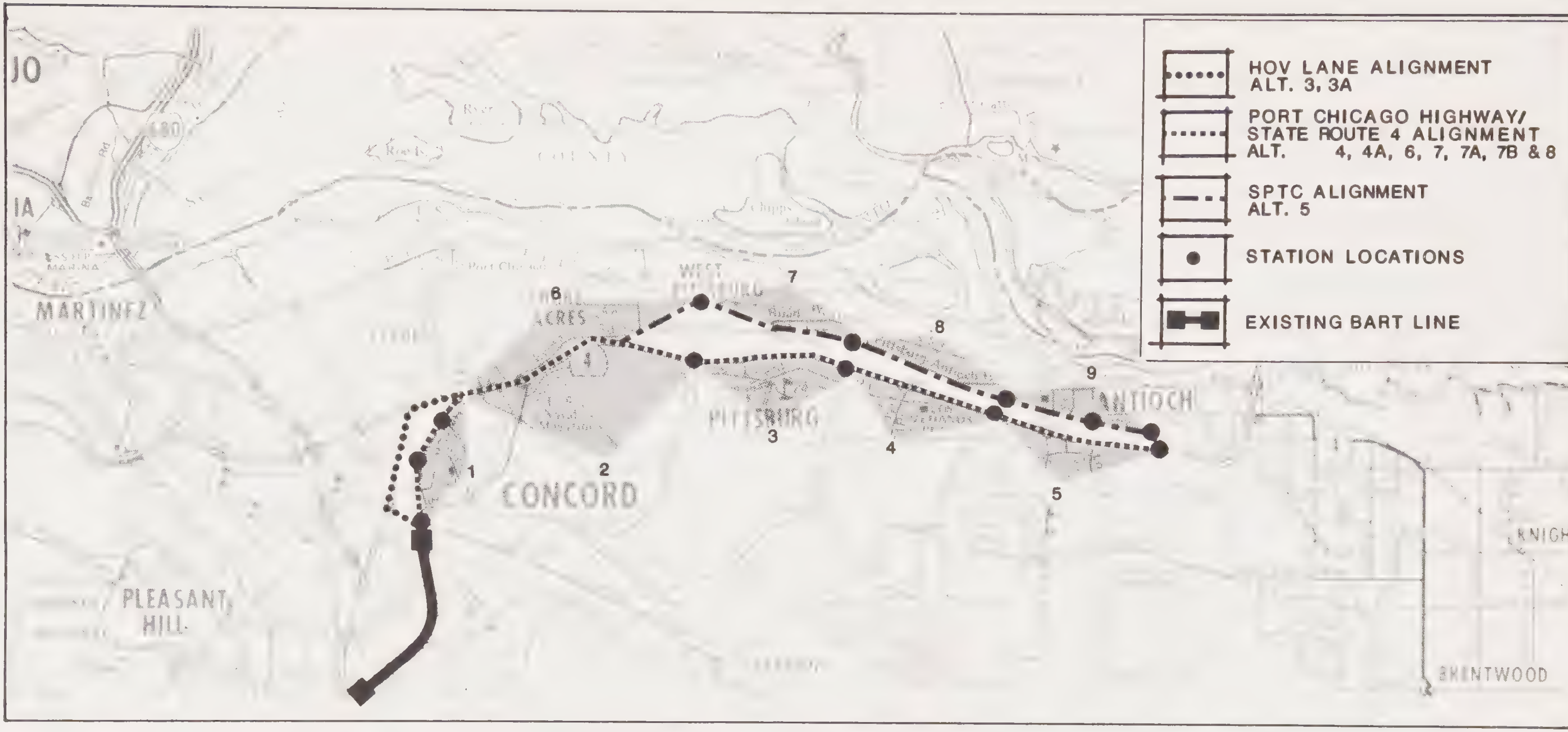
Area[a]	1	2	3	3A	4	4A	5	6	7	7A	7B	8
1		7 ac			30 ac 14 res	30 ac 14 res	30 ac 14 res	31.1 ac 22 res	39.9 ac 22 res	39.9 ac 22 res	39.9 ac 22 res	31.1 ac 22 res
2		1.7 ac	20.5 ac 4 res	20.5 ac 4 res	35.2 ac 2 res	35.2 ac 2 res			35.2 ac 2 res	35.2 ac 2 res	35.2 ac 2 res	35.2 ac 2 res
3		2.5 ac	30.3 ac 4 res	30.3 ac 4 res	43 ac	58 ac			43 ac		43 ac	58 ac
4			22.7 ac		31.5 ac	31.5 ac			31.5 ac			31.5 ac
5			19.4 ac 1 res		47 ac 1 res				48 ac 1 res			
6							35.7 ac					
7							40.6 ac					
8							30.6 ac					
9							33 ac 30 res					
TOTAL		11.2 ac —	92.9 ac 9 res	50.8 ac 8 res	186.7 ac 17 res	154.7 ac 16 res	169.9 ac 44 res	31.1 ac 22 res	197.6 ac 25 res	75.1 ac 24 res	118.1 ac 24 res	155.8 ac 24 res

ac - acre
res - residential

a See Exhibit 5.1-1 for area location.

Source: Bechtel Civil, Inc. 1988.

JBX/4580001E1x



Note: Numbers Correspond to Areas in Tables 5.1-2 and 5.1-3.

Right-of-Way and Relocation Index

Pittsburg-Antioch Corridor AA/DEIR

North 0 1.5 3 MILES

BART

Exhibit 5.1-1

TABLE 5.1-3

RELOCATIONS BY ALTERNATIVE

Area[a]	1	2	3	3A	4	4A	5	6	7	7A	7B	8
1					14 res 4 com	14 res 4 com	14 res 4 com	22 res 10 com	22 res 10 com	22 res 10 com	22 res 10 com	22 res 10 com
2			4 res 3 com 6 ind	4 res 3 com 6 ind	2 res	2 res			2 res	2 res	2 res	2 res
3			4 res 9 com	4 res 9 com	9 com	9 com			9 com		9 com	9 com
4			vac		vac	vac			vac			vac
5			1 res		1 res				1 res			
6							vac					
7							21 com					
8							vac					
9							30 res 3 com 4 ind					
TOTAL			**9 res 12 com 6 ind**	**8 res 12 com 6 ind**	**17 res 13 com**	**16 res 13 com**	**44 res 28 com 4 ind**	**22 res 10 com**	**25 res 19 com**	**24 res 10 com**	**24 res 19 com**	**24 res 19 com**

res - residential
com - commercial
ind - industrial
a See Exhibit 5.1-1 for area location.

Source: Michael Brandman Associates, Inc. 1988.

JBX/4580001E1x

Mitigation Measures

Alternatives 3 and 3A, and Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 should implement the following measures to reduce potential relocation effects to a level of insignificance.

1. Relocation benefits shall be provided to residences and businesses that require relocation due to the implementation of the proposed rail alignments and/or stations. The relocation benefits shall be provided in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

2. BART shall implement their program to assist residential and business owners to find replacement residences and business locations. A Relocation Advisor shall be identified to each displacee to assist the property owner in finding properties being offered for sale or rent that are suitable in condition, price, and rental range. The Relocation Advisor can also provide information relative to zoning ordinances, public transportation, and other economic and general information which may assist the business owner or tenant.

5.1.6 MITIGATION MEASURES

Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 should implement the following measure to reduce potential inconsistencies with the City of Concord's local plans and policies.

1. Amendments to the City of Concord General Plan Land Use Element and Circulation Element shall be requested and approved for the extension of the rail line from the existing Concord Station to Port Chicago Highway.

Alternative 5 (LRT to Antioch via SPTC) should also implement the following measure to reduce inconsistencies with the West Pittsburg General Plan and policies.

2. Amendments to the West Pittsburg General Plan Land Use Element and Circulation Element shall be requested for the alignment of the rail line from State Route 4 to Willow Pass Road and from Willow Pass Road to the SPTC line.

5.2 ECONOMIC ACTIVITY/DEMOGRAPHIC IMPACTS

The alternatives being evaluated vary in the degree to which they would cause economic impacts because of changes to accessibility within the corridor and region. The rail Alternatives (Alternatives 4 through 8) would improve regional accessibility more than Alternatives 1, 2, 3, and 3A. As accessibility is improved, the advantages of living and doing business in the Pittsburg-Antioch Corridor increase. Since proximity to the transportation system is an advantage for system users, often more concentrated growth occurs around station areas. This growth is possible if local governments increase allowable densities in the immediate vicinity and higher density development is economically feasible. It is likely that this growth is due to a

redistribution of growth within the region, rather than to a net increase in growth for the region.

Table 5.2-1 summarizes the economic/demographic impacts from the various system alternatives. There are no significant impacts from Alternatives 1, 2, 3, and 3A. Among Alternatives 4 through 8, Alternative 6 (BART to North Concord/Martinez) has the fewest impacts, since it would cover the shortest distance. Alternative 7 (BART to Antioch) would have the greatest impact since it could increase transit-accessible employment opportunities and lead to corridor and station area development, given supportive local policies. Impacts from LRT Alternatives 4 and 5 are similar to those from Alternative 7 (BART to Antioch), but to a lesser degree because of lesser patronage. However, none of the economic impacts are significant.

The following section explains these impacts from the corridor alternatives. They are grouped as follows: Alternatives 1, 2, 3, and 3A and Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8. First, impacts of the alternatives on study area population, employment, and real estate development are examined. Second, localized development impacts are discussed. Finally, the revenue impacts, potential for value capture revenues, and construction and operation employment impacts are presented.

5.2.1 REGIONAL GROWTH

Population Impacts

Forecasts of population growth provided by (ABAG) are predicated on several assumptions, one of which assumes that sufficient transportation infrastructure will be in place to handle projected growth. Consequently, ABAG's projections do not represent a baseline forecast of population growth in the absence of transportation improvements (ABAG 1987).

In general, an improvement in infrastructure alone is insufficient to lead to major population changes. Other factors, such as the regional economy and the availability of employment and housing, are more critical. It is unlikely, therefore, that an improvement in the transportation system--be it a rail or nonrail alternative--will lead to a change in projected corridor area or regional population growth (UMTA guidelines for transit project planning issued in September 1986 reflects this assumption). The more likely effect would be a concentration of development around station areas, which could increase population at station area locations if the development included a residential component. A transportation system improvement could also result in an increased rate of population growth along the corridor area if market demand responded to improved accessibility of the area.

Employment Impacts

The corridor area has experienced expansion in employment in the past 20 years and is projected to continue employment expansion, but probably at a rate that is less than the rate of household growth in the east county cities of Pittsburg, Antioch, and Brentwood. One of the problems faced in the corridor is the geographic imbalance between employment and residential growth. This imbalance results in long commutes and overcrowded streets and highways, particularly along the State Route 4 corridor.

TABLE 5.2-1

SUMMARY OF ECONOMIC/DEMOGRAPHIC IMPACTS OF SYSTEM ALTERNATIVES

	Alternative						
Potential Impacts	1	2	3	3A	4	4A	5
Regional Population	None	None	None	None	None	None	None
Regional Employment	None	None	None	None	Some increase in transit-accessible employment.	Some increase in transit-accessible employment.	Some increase in transit-accessible employment.
Corridor Real Estate Development	None	None	None	None	Given supportive local policies, there could be a clustering of intensive development along transit corridor.	Given supportive local policies, there could be a clustering of intensive development along transit corridor.	Given supportive local policies, there could be a clustering of intensive development along transit corridor.
Station-by-Station Development	None	None	None	None	Given supportive local policies, there could be more intensive development adjacent to some station areas.	Given supportive local policies, there could be more intensive development adjacent to some station areas.	Given supportive local policies, there could be more intensive development adjacent to some station areas.
Revenues and Tax Base	None	None	None	None	Minimal	Minimal	Minimal

TABLE 5.2-1 (Continued)

	Alternative				
Potential Impacts	6	7	7A	7B	8
Regional Population	None	None	None	None	None
Regional Employment	Minimal increase in transit-accessible employment.	Increase in transit-accessible employment	Minimal increase in percent of transit-accessible employment.	Some increase in transit-accessible employment.	Some increase in transit-accessible employment.
Corridor Real Estate Development	Some clustering of intensive development along transit corridor but less so than Alternatives 4, 4A, 5, 7, 7A, 7B and 8.	Given supportive local policies, there could be a clustering of intensive development along transit corridor.	Some clustering of intensive development along transit corridor but less so than Alternatives 4, 4A, 5, 7, 7A and 8.	Given supportive local policies, there could be a clustering of intensive development along transit corridor.	Given supportive local policies, there could be a clustering of intensive development along transit corridor.
Station-by-Station Development	No impact, due to Naval Weapons Station.	Given supportive local policies, there could be more intensive development adjacent to some station areas. Impacts would be greater than for other rail Alternatives; however, these impacts would not be significant.	Given supportive local policies there could be more intensive development adjacent to West Pittsburg Station.	Given supportive local policies, there could be more intensive development adjacent to the West Pittsburg and Pittsburg station areas.	Given supportive local policies, there could be more intensive development adjacent to some station areas. (An intermodal transfer station is usually a good candidate for more intensive development. However, since North Concord is surrounded by the Naval Weapons Station, the development advantages are more limited.)
Revenues and Tax Base	Minimal	Minimal, but greater than for other rail Alternatives 4, 5, or 8.	Minimal	Minimal	Minimal

An improvement in the transportation system along the Pittsburg-Antioch Corridor would not result in more regional employment growth, but it could make job opportunities more accessible to the labor force in the corridor. Rail Alternatives would improve commuting conditions to a greater degree than the nonrail alternatives, since the rail alternatives include most of the nonrail improvements, as well as the benefits of rapid transit opportunities. The one exception is BART to North Concord/Martinez, which would not provide direct rail access to regional employment opportunities for the labor force living in the east county area. The labor force living in the east county area would need to drive to the North Concord/Martinez BART Station. Since this trip would entail a drive of 10 to 15 miles or more, it is unlikely that there would be a major change in commuting patterns except for those east county workers who had avoided using BART due to the congestion in downtown Concord. Since the North Concord location would be less congested, they might then utilize BART and therefore benefit from rapid transit.

5.2.2 REGIONAL REAL ESTATE

Impacts of the Alternatives on Corridor Development

At present there are several constraints (water, sewer, etc.) on development along the corridor area, including congestion along State Route 4. Most cities need to expand services or infrastructure to accommodate additional growth. (See Appendix B for more information.) These constraints are expected to be temporary since in all cases, infrastructure expansions are planned.

Real estate development is affected the most along the transit alignment itself because the immediate advantages for commercial (and to a lesser degree, residential) development occur within close proximity to the alignment. Reasons for this include visibility of signs from the BART/LRT trains (serving as advertisement for the commercial development) and ease of accessibility to transit stations. Transit may affect the nature and timing of new development on vacant land or redevelopment of areas already developed. Given the abundance of vacant land along the alignment, it is more likely that development impacts would be greater on future new development than on redevelopment; however, none of the impacts is significant. The following list summarizes the amount and nature of vacant land along the alignment and current general plan designation for these areas.

City of Concord Developable Land (Adjacent to All Rail Alternatives)

Development opportunities continue to exist in the downtown redevelopment area of the city, particularly in the area along Willow Pass Road (west of Galindo) and the area west of Todos Santos Plaza, bounded by Concord Avenue, Salvio Street, and Sutter Street. These areas are designated for mixed commercial/residential and office development. North of State Route 4 there are additional development opportunities in the industrial area west of Port Chicago Highway, particularly in the vacant land parcels south of Bates Avenue, adjacent to State Route 4. Although this area is fairly remote from the alignment, it is one of the few areas of vacant land near the North Concord/Martinez Station. This area is suitable for warehouse, research and development (R&D), or light manufacturing uses. Transportation impacts on development vary along this segment of the alignment. In the downtown Concord area, the existing BART station may have encouraged higher density development.

West Pittsburg Developable Land (Adjacent to All Rail Alternatives, Except Alternative 6)

There is vacant land along State Route 4 from Willow Pass Road in Concord to Willow Pass Road in West Pittsburg. It is unlikely this will be developed since it is hilly terrain and designated as general open space by Contra Costa County. South of State Route 4 there is vacant land designated for low density housing (a maximum of seven units per acre). This area extends almost to Bailey Road. Additionally, two undeveloped sites have been designated as shopping centers: one is at the intersection of Willow Pass Road and Port Chicago Highway, and the other is on the west side of Bailey Road between State Route 4 and West Leland, adjacent to the BART park-and-ride lot. High density housing is planned for the vacant lot west of the proposed Bailey Road shopping center.

The planned State Route 4 interchange at Range Road may provide opportunities for low density residential development in the nearby vacant parcels to the south. Finally, vacant land along the SPTC tracks near the Shell property, east of Port Chicago Highway, is designated for industrial use. Development impacts are mixed. Some of the vacant land cannot be developed on because it is hilly. Other vacant land will already be developed as low density housing before the rail system is extended. The primary development impact will be on the planned shopping centers and high density housing. However, since the planned developments would be completed before there was a BART or LRT extension, there would be no impacts on initial financial feasibility of these projects. In the long run, however, these projects could experience greater cash flow than would otherwise be possible.

City of Pittsburg Developable Land (Adjacent to Alternatives 4, 4A, 5, 7, 7B, and 8)

There are large plots of vacant land as well as land with vacant industrial buildings to the east of the city. North of the SPTC tracks are 195 acres of vacant land lacking infrastructure and 104 acres of land with vacant industrial buildings. Between the railroad tracks and State Route 4 east of Harbor Street to Somersville Road are 146 acres of vacant land designated for industrial or industrial park use, and an additional 85 acres of vacant land designated for a shopping center. Seeno Construction Company owns most of this land (referred to as the Baker property). Construction has already begun on a new shopping center located along Century Boulevard.

North of the railroad tracks are 58 acres of vacant and available space in industrial and other structures. Most of this space is part of the USX (formerly U.S. Steel) property and is being marketed by U.S. Steel Realty Corporation as an industrial park.

This segment of the alignment could experience the greatest development impacts from a rail extension, since there is so much vacant land, and land that is being redeveloped. Again, it is a question of whether these vacant lands are developed in low density uses, primary industrial and warehouse, before the system is developed. If that occurs, then there is a smaller benefit from transit, since transit is most beneficial for commercial, office, and residential uses. (There are a greater number of employees, customers, and residents in these latter uses than in industrial uses, which tend to be land intensive.) This is one of the alignment segments where delaying development until a market develops for more intensive uses could lead to more beneficial development impacts.

City of Antioch Developable Land (Adjacent to Alternatives 4, 4A, 5, 7, and 8)

There are about 200 acres of vacant land located south of State Route 4 and north of Buchanan Road, between the Los Medanos Waterway and slightly to the east of Somersville Road. This area has been designated for commercial and multifamily residential use. On the west side of Antioch are 500 acres of mostly vacant land located to the west of Somersville Road and north of the SPTC tracks. This area is zoned as a planned industrial district. U.S. Steel Realty has recently subdivided this area to market the land.

Directly south of the downtown Antioch area are some scattered vacant residential parcels along Lone Tree Way, south of State Route 4. However, the majority of the vacant land in Antioch is concentrated on the east side of the city. Proposed development for this area is discussed in three separate specific plans. One of these, the Southeast Antioch Area Plan, covers approximately 5,000 acres. The anticipated population in this area is estimated to be 44,400 residents. Currently, most of the land in this planning area is vacant. Much of the vacant land is zoned either for industrial or residential use. As mentioned above, industrial uses benefit less from a transit system than do more intensive uses. Another planned land use in this area is residential. Some of this is multifamily, and some is single-family. Although the market favors single-family housing in this area, there would be more direct benefits to multifamily housing from a system extension. Again, this is an area where delaying development currently supported by the market (industrial and single-family residential uses) could lead to more beneficial development impacts in the long run. Finally, the area surrounding the East Antioch Station is partly vacant and located within a redevelopment area.

Additional Sources of Developable Land

In addition to these large tracts of vacant land, there is other land available for development. For example, publicly encouraged redevelopment of improved sites provides another source of developable land. Several cities are planning and implementing downtown redevelopment activities. The City of Concord is by far the most active, but the City of Pittsburg is also redeveloping its downtown area, primarily through facilitating private sector activities and improving infrastructure.

As with employment, the rail alternatives (as compared to Alternatives 1, 2, 3, and 3A) would have the greatest impact on new development. Transit could serve as an amenity to new residential, retail, office, and R&D development. Transit, particularly BART, improves accessibility of the corridor area to other points within the San Francisco Bay Area. Consequently, sites that would formerly be out of the Pittsburg-Antioch labor and retail market areas would now be located within them. For residents and employers, this means that they can consider a wider geographic range for employment, and for retailers, possibly an expanded customer base. Although the corridor area may not experience more development overall, the transit alternatives could serve to cluster intensive development adjacent to station areas, if market demand were present.

It can be argued that more intensive development on corridor vacant lands could result in higher land values than would industrial development (which is currently the most prevalent land use designation for vacant lands along the alignment). The location of the Pittsburg-Antioch Corridor is well-situated for office, commercial, and service functions. Although it is not near San Francisco, it is well-located with respect to Solano and San Joaquin counties--both of which are high growth areas. Over time, the proximity of the Pittsburg-Antioch Corridor to these two growth areas should increase demand for sites located within the corridor. This demand could augment the potential for increased demand due to transit, thereby making intensive development more financially feasible. Although demand for these other land uses may be several decades into the future, it could be there by the time the transit system could be operating.

Mitigation Measures

The presence of a transportation system, in itself, would not result in more intensive development along the alignment until there is adequate market demand and supportive local land use policies are enacted. If that market demand is to be realized in intensive alignment development, then local zoning policies need to be supportive. At present, much of the corridor vacant land is designated for industrial development which is not intensive. Affected cities and Contra Costa County may want to review their general plan policies regarding this industrial land and consider the following if encouragement of corridor development is desired:

- Increase Floor Area Ratios (FARs) for new development located along the alignment, particularly adjacent to station areas.

- Allow density bonuses for development around transit stations.

- Reconsider general plan use designations, and where appropriate, modify those policies to promote intensive land uses that can be benefited by transit, such as alignment areas in the cities of Pittsburg and Antioch.

5.2.3 STATION-BY-STATION

Development Impacts

This section discusses impacts of the rail alternatives (4 through 8) on station area real estate development patterns. The nonrail alternatives are not addressed in this section for the following reasons. Alternative 1 would not result in any new stations or park-and-ride facilities, and although nonrail Alternatives 2, 3, and 3A would result in new park-and-ride lot areas, significant changes in real estate development patterns would not occur. The principal mechanism through which LRT or BART stations affect development potential of surrounding sites is by increasing rents that can be charged for use of those sites. Projected revenues are then higher, yielding greater cash flow, which, in turn, increases projected return on an investment. In turn, this often modifies financial feasibility of projects that can be erected on those sites. In other words, a project which could not be developed at prevailing (pretransit) rent levels may become financially feasible when a transit station is constructed.

Critical to this process is the ability to charge higher rents for a station area site. The main explanation for the ability to charge higher rents is improved accessibility. The sites are more accessible to other areas within the region. This is particularly true of BART, because BART improves regional accessibility to a greater degree than LRT. (BART is a regional system, travels faster than LRT, and does not require an intermodal transfer, which increases travel time.) Retail, residential, and office space users receive benefits. For example, retailers find that, certeris paribus, they can expect to attract more customers to a site adjacent to a transit station than would otherwise be possible at a distance further away, since customers can use the transit system for travel. Also, retailers expect that BART patrons will be customers. Because retailers expect higher sales at a location adjacent to a transit station, they are willing to pay higher rents. Also, employers pay more rent for office and R&D locations adjacent to a transit station, since they anticipate that their workers will find that proximity to transit is a noncash benefit of their employment.

For each BART and LRT station, Table 5.2-2 briefly summarizes adjacent land uses, future development scenarios (or redevelopment plans), and impacts of a transit station on future development around the station based on the potential effects of increased rents discussed above. Based on the information in Table 5.2-2, Table 5.2-3 groups the alternative BART and LRT stations into four categories which evaluate the likelihood that transit will affect development or redevelopment around station areas (see Appendix B).

In most cases, the presence of a station would not dramatically affect station area real estate trends. It would take up to 10 years to plan and implement a transit system. During this time period, current planned development and redevelopment activities will be well advanced, and much of the vacant land in this corridor will be largely developed. Although identification of station area sites could influence real estate development in advance of system construction since land owners could anticipate transit benefits, the actual benefits from an operational transit system would occur too late to have a major impact on development, although over time, rents and land values in station areas would be higher than for comparable areas located at a distance from station areas. The one exception would be if local governments intervened and required higher density uses around the station area. This could result in land-banking of these sites until the market could support higher density uses.

An assessment of station area development trends is useful in understanding the nature of transit impacts on future station area development patterns. The first situation is one where there is either current development or redevelopment activity, or where such activity is likely to occur within the next decade prior to the implementation of the project given the level of market demand. The Concord station area falls into this category. Development is occurring in this area without a BART or LRT extension; however, the presence of an existing BART station has been instrumental in encouraging development. This development should be completed within 5 to 15 years, if market demand for office space increases again in the 1990s. A rail extension would help make these developments more successful. The Mount Diablo station area is another example of an area where redevelopment may be completed by the time the system is operating. Although the local market does not currently support high density residential development (City of Concord 1985a), it is likely that office development connected to the hospital complex will continue

TABLE 5.2-2

BART AND LRT STATION AREA DEVELOPMENT TRENDS AND POTENTIAL TRANSIT IMPACTS

Station Area	System Alternatives	Existing Land Uses and Major Activity Centers	Future Development/ Redevelopment Plans	Transit Impacts on Future Development
Concord	4, 4A, 5, 6, 7, 7A, 7B, and 8	Downtown activities, including office and commercial uses, Concord BART station, and parking. Major office buildings include the Bank of America office complex and the two Concord Centre buildings. A residential area is adjacent as well.	Central Concord Redevelopment Plan applies to area. Plan regulates uses, setbacks, FARs, etc. Majority of new development is privately financed. A hotel is planned on BART-owned property in the near future.	Development may be completed by the time transit is operating. Transit could help its success.
Mount Diablo	4, 4A, and 5	Primary land use is residential. Other major land uses include medical offices, Mount Diablo Hospital, and School and Baldwin Park. This is the oldest neighborhood in the city.	Part of the area is included within the North Todos Specific Plan area. Purpose of Specific Plan is to allow for greater variety and more intense development, e.g., medical offices to serve hospital and increased residential densities, while still retaining existing single-family character.	Transit could strengthen area as a medical center.
North Concord/Martinez	4, 4A, 5, 6, 7, 7A, 7B, and 8	Primarily residential to the south. The U.S. Naval Weapons Station is located to the northeast. An industrial area is to the northwest, and a golf course is to the north.	A large auto-oriented discount retail store will be developed on vacant land to the northwest of station area.	Limited impact since much of the area is already developed as single-family housing or is owned by the Navy.
West Pittsburg	4, 4A, 7, 7A, 7B, and 8	Residential, some vacant land, mobile home park, and a school.	The area will experience continued residential development, since there is vacant land which is designated for residential use in the general plan.	Limited impact unless future residential development would be of higher densities. Higher densities are not designated by the general plan for this area, nor do they reflect current market trends.
West Pittsburg	5	Some residential and commercial uses, Shell Oil Company, other industrial uses, and vacant land (to the north of proposed station).	Vacant land is designated in the general plan to be an industrial park area, with some multifamily residential areas and a shopping center at the	Transit could affect timing and type of new development.

TABLE 5.2-2 (Continued)

Station Area	System Alternatives	Existing Land Uses and Major Activity Centers	Future Development/ Redevelopment Plans	Transit Impacts on Future Development
Pittsburg	4, 4A, 7, 7B, and 8	Existing land uses are mixed. To the north is the Pittsburg City Park. Other surrounding land uses include residential, commercial, and some industrial. There are shopping centers about 1 mile south.	The area is located within the enterprise zone and the Los Medanos Community Development Plan area. One possible plan would be to relocate city offices north, to assist downtown revitalization.	Transit could affect development, particularly if city offices were relocated, and vacated land made available for development.
Alternative Pittsburg Location	4, 4A, 7, 7B, and 8	Area overlaps with above station area. Additional uses to the East include warehouse and residential land uses.	Station would be located farther from the municipal buildings. It is located within the Enterprise Zone and the Los Medanos Community Development Plan area.	Similar to Pittsburg Station area above.
Pittsburg	5	Primarily residential and commercial, including warehouses. Some of the buildings are vacant. Area appears blighted.	Station is located near the southern boundary of the area included within the Downtown Specific Plan which aims to upgrade downtown area by improving infrastructure and buildings. A redevelopment area is located to the north of the station area. It is located within the Enterprise Zone and the Los Medanos Community Development Plan area.	If downtown area is publicly developed, then transit could strengthen these redevelopment activities. However, transit alone would be insufficient to cause private redevelopment, given weak market strength in area.

Source: Recht Hausrath & Associates, 1988.

TABLE 5.2-2 (Continued)

Station Area	System Alternatives	Existing Land Uses and Major Activity Centers	Future Development/ Redevelopment Plans	Transit Impacts on Future Development
			corner of Willow Pass Road and Port Chicago Highway. Station is located within the West Pittsburg Redevelopment Project Area.	
West Antioch	4, 4A, 7, and 8	Existing land uses include Los Medanos Junior College, residential, commercial, and industrial uses (sand and gravel mining). Additionally, there is both vacant and agricultural land. Some of this land is designated as commercial and the rest is designated as manufacturing/industrial. County East Mall is located farther south of the station area.	A large shopping/office complex is under construction adjacent to station (between the SPTC tracks and State Route 4, west of Somersville Road). The area adjacent and south of State Route 4 is currently developing with retail and services uses. Station is located within the Los Medanos Community Development Plan area.	Transit will assist the success of the new shopping center. It could affect direction of development on vacant lands, if General Plan designations were changed to more intensive uses.
West Antioch	5	(This station area is discussed under West Antioch Alternatives 4, 4A, and 7.)		
Antioch	5	Existing land use is primarily residential, with some commercial bordering A Street, and some industrial land adjacent to SPTC tracks.	Area is developed. No specific area or redevelopment plans apply to area.	Development impacts would be minimal, since area is already developed.
East Antioch	4, 5, 7	Existing land uses are residential, industrial, and agricultural. There is an abundance of vacant land, more to the north of State Route 4.	Area to the south of State Route 4 is contained within the boundaries of the Southeast Antioch Specific Plan. The plan's purpose is to guide new development on vacant lands in area. Station is located within Antioch's Redevelopment Area No. 3. Vacant land is zoned north of State Route 4 for industrial uses, and south of State Route 4 for commercial/office use. The station is located within Redevelopment Project Area No. 3.	Transit could affect timing and type of new development.

TABLE 5.2-3

SUMMARY OF LRT AND BART IMPACTS ON STATION AREA DEVELOPMENT POTENTIAL

Station Areas Where Development or Redevelopment Activities will be Completed by the Time Transit System is Operating.

LRT (Alternatives 4, 4A and 5): Concord, Mt. Diablo

Station Areas Where There is Vacant Land. Transit Could Affect Timing and Type of New Development.

LRT (Alternative 4): same as BART alternative 7

LRT (Alternative 4A) West Pittsburg, Pittsburg, and West Antioch

LRT (Alternative 5): West Pittsburg, Pittsburg, West Antioch, and East Antioch

BART (Alternative 7): West Pittsburg, Pittsburg (both alternatives), West Antioch, East Antioch

BART (Alternative 7A): West Pittsburg

BART (Alternative 7B): West Pittsburg and Pittsburg (both alternatives)

BART/LRT (Alternative 8): same as LRT alternative 4A

Station Areas Which are Surrounded by Existing Developments. Transit's Effect Would be Minimal in the Near Term.

LRT (Alternative 5): Antioch

Station Areas Located in Restricted Use Areas. Transit Would Have Little or No Impact.

BART (Alternatives 6, 7A, and 7B): North Concord/Martinez

LRT (Alternatives 4, 4A and 5): North Concord/Martinez

BART/LRT (Alternative 8): North Concord/Martinez

Source: Recht Hausrath & Associates 1988.

over the next 15 years. An LRT station could benefit employees commuting to this hospital area and could possibly encourage higher density office development.

The next group of station areas are those which are surrounded by some vacant land, but which do not currently face strong demand for development. Some new developments may already be constructed, but vacant land remains. This is the case at the West Antioch station area. The presence of a BART station in these areas could result in the land being developed more rapidly and more intensely, and perhaps favoring higher rent paying uses, such as R&D or office development over industrial development. The presence of an LRT station would affect development but to a lesser degree than BART since LRT carries fewer patrons.

This situation described above prevails at the alternative BART or LRT station areas in West Pittsburg, Pittsburg, West Antioch, and East Antioch. There are differences among these four areas in terms of prevailing market demand and types of public policies guiding development. For example, market demand is weakest in West Pittsburg and strongest in West and East Antioch. The Pittsburg station areas potentially face the greatest influence from public policies since they are within the jurisdictions of two projects (Los Medanos Community Development Plan and the Enterprise Zone) intended to improve employment and development within a broad area of Pittsburg, particularly north of State Route 4. The creation of a BART station at Railroad Avenue and State Route 4 would strengthen future redevelopment activities. The LRT station at the SPTC tracks and Railroad Avenue would be located closer to the center of the older downtown area which is undergoing more intensive redevelopment. Consequently, it could have even more of a positive impact on downtown redevelopment activities, if traffic congestion did not become a problem (Pride 1987).

The third group of stations are those which are surrounded by existing development. Only the Antioch LRT station falls into this category. Transit's effect would be minimal in the near term since land values are not high enough to justify private redevelopment of sites; although, in the long run, redevelopment could be feasible. Until there is market demand for land in these areas for the types of developments that pay higher rents, it is unlikely that LRT would have any redevelopment impacts.

The final group of station areas are those where transit-induced development impacts are unlikely, since these areas are not influenced by market forces. The North Concord/Martinez station is the only station falling into this category. The proposed station is located on the boundary of the U.S. Naval Weapons Station, Concord. In addition, there is a golf course north of State Route 4. Unless land use radically changed in this area, it is unlikely that transit will lead to any development impacts, although workers at the U.S. Naval Weapons Station would benefit from the proximity of transit at the North Concord/Martinez Station if shuttle service is provided.

Mitigation Measures

For those station areas where redevelopment planning and/or activities are underway, it is recommended that local agencies consider a more active role in land assembly, if it appears that without public intervention, redevelopment of station area sites would not be of the type or the densities that are compatible with transit.

Local governments may review general plan designations for the vacant lands surrounding station areas and consider requiring higher density uses around these stations, if encouragement of station area development is desired. Although this may result in delayed development, ultimately it will lead to efficient land utilization and increased system patronage.

5.2.4 IMPACTS ON REVENUES AND TAX BASE

Property taxes and sales taxes are the principal revenue sources which could be affected by improvements in the transportation system. Again, the rail alternatives--particularly BART--would have a greater impact on these revenue sources than would the nonrail alternatives, although impacts are limited in either case.

In general, property tax values could rise in the Pittsburg-Antioch Corridor due to BART or LRT, since properties in the area could face higher demand. Higher values result in greater property tax revenues, although revenues lag behind price appreciation due to Proposition 13. In some cases, there is relocation of development activity within a city or region. So, although there is a shifting of the location of revenue growth, there is not an absolute increase. Another possibility is that land is developed faster because the rail system has improved accessibility. Again, in this case, there would not be a greater absolute growth over time, but in the short-term (15 years or less), there could be accelerated growth.

One exception to these two cases is the situation in which the presence of a transit station encouraged higher quality construction than would otherwise occur in the city or region. In this latter case, there would be a small, positive, net revenue impact.

Sales tax revenues would increase only minimally. Retailers may alter their locational decisions based on the presence of rapid transit. However, it is likely that the clustering of retail activities at a transit station is due to a relocation of area retailers, rather than due to an absolute growth in the number of establishments and associated sales. (See Appendix B for more discussion.)

5.2.5 POTENTIAL FOR DERIVING TRANSIT REVENUES FROM VALUE CAPTURE

Transportation system improvements can also increase the value of land and properties. This value increase is most noticeable adjacent to station areas. The rail alternatives are much more likely to increase land and property values than Alternatives 1, 2, 3, or 3A. This value increase can sometimes provide an additional source of transportation revenues, particularly to fund operations.

One source of station construction revenues could be a sharing in the tax increments already being collected by a redevelopment agency. If it can be demonstrated that property values adjacent to a station will increase at a faster rate due to the development of an LRT or BART station than they would in the absence of a station, then the transit operator could be in a good position to negotiate with the affected redevelopment agency to share in a percentage of the tax increments collected in the immediate area, since the redevelopment agency's tax revenues will be greater. There is a range of possible revenues that could be collected, depending on what

percentage of the increment the redevelopment agency shares, the growth in the tax base due to the presence of a transit station, and the period of time during which increments would be shared.

There are also revenue sources for operations and maintenance. The first could be concessions operated at BART Stations. These concessions are possible because retail and service demand is generated by BART patrons. Thus, again, concessions are examples of transit revenues made possible by an increase in value to the private sector. Five system alternatives include BART or a BART component which could provide space for concessions. Possible annual revenues in 1987 dollars from these alternatives can be projected based on current revenues provided by concessions at the Pleasant Hill BART Station (an example of a through station) and the Concord Station (an example of a terminal station). These revenue projects are as follows:

Alternative 6:	$28,648 annually
Alternative 7:	$107, 528 annually
Alternative 7A:	$48,368 annually
Alternative 7B:	$68,088 annually
Alternative 8:	$24,184 annually

A second source of revenues for operations and maintenance could be provided by joint development projects at BART Stations, particularly at the Pittsburg, West Antioch, and East Antioch Stations. These revenues would not be realized until after the year 2000, since local real estate market conditions would not support joint development projects until that time. Without projections of possible rents, it is not feasible to project potential revenues at this time.

5.2.6 EMPLOYMENT IMPACTS OF CONSTRUCTION AND OPERATION

The construction and operation of the rail alternatives would have a positive impact on the regional economy by creating more jobs. For a 3- to 5-year period in the 1990s, jobs would be generated on a temporary basis to construct needed facilities. On a continuing basis, jobs would also be created to operate the transit facilities once completed. Additionally, there would be a "multiplier effect" or indirect employment impacts, since newly employed workers would consume additional goods and services whose provision would generate additional employment. (Indirect employment effects could also be generated through expenditures on materials during system construction. Since a large percentage of these materials will come from outside the region, this contribution to indirect employment impacts is less important.)

Table 5.2-4 presents direct and indirect employment impacts from both the construction and operation phases of project alternatives. These direct employment estimates were derived from projections of the construction and operations labor cost data for each alternative. The construction employment estimates cover the entire construction period, whereas the operations employment estimates are for the year 2000 only. The amount of employment that would be generated is directly related to the amount of expenditures and is calculated by dividing total labor costs by a worker's average, annual wage plus fringe benefits. (Different wage estimates were used for construction and operations.) Indirect employment estimates are also positively related to expenditures and are related to direct employment estimates through empirically validated multipliers that vary by employment sector.

TABLE 5.2-4

EMPLOYMENT IMPACTS OF CONSTRUCTION AND ONGOING OPERATIONS

Alternative	Construction[a]			Operations[b]		
	Direct Employment	Indirect Employment Effect[c]	Total Employment (Direct and Indirect)	Direct Employment	Indirect Employment Effect[d]	Total Employment (Direct and Indirect)
1 (No-Build)	0	0	0	0	0	0
2 (TSM)	2	3	5	64	80	144
3 (HOV to Antioch)	1,589	2,288	3,877	87	109	196
3A (HOV to Pittsburg)	1,093	1,574	2,667	78	98	176
4 (LRT to Antioch)	3,340	4,810	8,150	259	324	583
4A (LRT to West Antioch)	2,689	3,872	6,561	238	298	536
5 (LRT to Antioch via SPTC)	3,310	4,766	8,076	274	342	616
6 (BART to North Concord	1,199	1,727	2,926	119	149	268
7 (BART to Antioch)	4,553	6,556	11,109	340	425	765
7A (BART to West Pittsburg)	2,206	3,177	5,383	188	235	423
7B (BART to Pittsburg)	3,171	4,566	7,737	239	299	538
8 (BART to North Concord/Martinez; LRT to West Antioch)	3,245	4,763	7,918	267	334	601

a Employment impacts are based on construction cost estimates. These costs primarily cover labor costs only. Where expenditures for vehicles, materials, or right-of-way acquisition can be clearly identified, they have been excluded. Construction costs would be spread out over a period of 3 to 5 years. Employment figures refer to person years of employment.

b Employment impacts are based on operation and maintenance cost estimates for the year 2000. Employment figures refer to person years of employment.

c Employment estimates are calculated with an indirect employment multiplier of 1.44 based on an average of multipliers derived by ABAG for highway and public utilities construction sectors.

d Employment estimates are calculated with an indirect employment multiplier of 1.25 based on an average of multipliers derived by ABAG for Transportation Services sectors.

Source: Recht Hausrath & Associates 1988.

As Table 5.2-4 indicates, the more expensive alternatives will generate the greatest direct and indirect employment effects during the construction and operating periods. Direct construction employment impacts will vary from zero Alternative 1 (no-build) to 4,553, for Alternative 7 (BART to Antioch). In general, rail alternatives (either LRT or BART) that extend to the cities of Pittsburg or Antioch will generate the most direct and indirect jobs, both during the construction and operation phases. Also, operation period employment is much less than construction employment, except for Alternative 2 (TSM).

Although employment requirements are high for many of the rail alternatives, they would not lead to significant impacts. Employment generation does not completely result in net, new job creation in Contra Costa County or in the larger San Francisco Bay region. Some workers may change from one job to another or may be underemployed and become fully employed. Consequently, the employment numbers presented in Table 5.2-4 refer to direct and indirect employment generated by system construction and operation, not net job growth--which would be less. Since the San Francisco Bay Area encompasses a large labor market area, it is not anticipated that employment impacts would result in regional labor shortages or competition among related industries for skilled workers.

5.3 NEIGHBORHOODS

5.3.1 NEIGHBORHOODS AFFECTED

This section analyzes the potential for the alternatives to divide neighborhoods, while Section 5.1 examined the potential land use impacts on particular uses within neighborhoods.

Implementation of Alternatives 1, 2, 3, and 3A would not adversely affect neighborhoods within the corridor. Alternative 1 would not implement a project and Alternatives 2, 3, and 3A (park-and-ride facilities) would only add vehicles to existing street rights-of-way. The addition of vehicles to existing streets would not result in a significant additional separation of neighborhoods. Implementation of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would not result in dividing the central business district neighborhood in the City of Concord. The majority of this business neighborhood is located west of the BART and LRT routes. Only a small portion of this neighborhood is east of the routes. Since the BART and LRT rail lines for each alternative are proposed to be aboveground, access to/from areas east of the central business district neighborhood would not be hindered by access to/from areas west of the neighborhood. Therefore, no significant effects on bisecting the central business district neighborhood would result from development of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, or 8.

Neighborhoods adjacent to Port Chicago Highway in the City of Concord would also not be affected by the implementation of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 because these neighborhoods are currently separated by Port Chicago Highway. Alternatives 4, 4A, 7, 7A, 7B, and 8 would use State Route 4 for their transportation routes through the cities of Pittsburg and Antioch. Currently, State Route 4 provides a substantial barrier to the creation of a neighborhood on both sides of the route in the cities of Pittsburg and Antioch. Because of this barrier, the implementation of Alternatives 4, 4A, 7, 7A, 7B, and 8 would not result in a significant effect on neighborhoods.

The community of West Pittsburg is considered one cohesive neighborhood except for a new development northeast of Willow Pass Road and Port Chicago Highway. Implementation of Alternative 5 (LRT to Antioch via SPTC) would affect the West Pittsburg neighborhood because rail operations would bisect the neighborhood as does the existing SPTC line activity. However, no significant effects on the Pittsburg neighborhood would occur because access would not be restricted to/from the west side of the community to/from the east side of the community.

In addition, Alternative 5 (LRT to Antioch vis SPTC) would bisect a neighborhood in the City of Pittsburg. A residential neighborhood, it is located east of Harbor Street and north and south of the SPTC line. Currently, the only access to the north or south side of this residential neighborhood is along Harbor Street. Implementation of Alternative 5 would result in an at-grade rail through this neighborhood which would contribute to the existing separation of this neighborhood. Harbor Street is currently an underpass at the SPTC line and would remain as the access link between the north and south side of this residential neighborhood after this alternative is implemented.

Alternative 5 would also bisect four neighborhoods in the City of Antioch. Currently, these four neighborhoods are bisected by the SPTC line. Access to/from the north side of these neighborhoods to/from the south side of these neighborhoods is currently provided by existing streets. Development of Alternative 5 would contribute to the existing separation of the neighborhoods in the City of Antioch and would require two streets (Somersville Road and Hillcrest Avenue) to be depressed at the SPTC line to maintain access between the north and south sides of these neighborhoods. The other existing streets that provide access to both sides of the SPTC line are currently depressed or overpass the SPTC line. Alternative 5 proposes to depress Somersville Road and Hillcrest Avenue, and with the implementation of these two street improvements, Alternative 5 (LRT to Antioch via SPTC) would not result in any significant additional effect to the separation of neighborhoods in the City of Antioch.

Table 5.3-1 provides a summary of the neighborhoods that would be affected by each alternative. However, none of the neighborhoods along the corridor would be significantly affected.

5.3.2 MITIGATION MEASURES

No mitigation measures are necessary.

5.4 VISUAL QUALITY AND AESTHETICS

5.4.1 GENERAL DISCUSSION

Visual impacts are potentially significant where an alternative would be sited within an area devoid of existing major transportation and/or rail line corridors and would be directly visible from nearby residential development. In other areas, for example within existing transportation corridors or when the project is viewed from commercial, institutional, or industrial development, impacts may occur but not at a level of significance.

TABLE 5.3-1

NEIGHBORHOODS AFFECTED ALONG ALTERNATIVE ALIGNMENTS

Transit Alternative	City of Concord Central Business District	Contra Costa County West Pittsburg	City of Pittsburg East Pittsburg	City of Antioch			
				West Antioch	Fairview	Mid Central	View
1							
2							
3							
3A							
4	X						
4A	X						
5	X	X	X	X	X	X	X
6	X						
7	X						
7A	X						
7B	X						
8	X						

Source: Michael Brandman Associates 1988.

JBX/4580001E1x

For the purposes of discussing impacts on visual resources, the proposed alternatives can be separated into four categories: (1) nonrail options (Alternatives 1, 2, 3, and 3A), (2) LRT construction options (Alternatives 4, 4A, and 5), (3) BART construction options (Alternatives 6 and 7, 7A, and 7B) and (4) LRT and BART combination (Alternative 8). The following discussion summarizes the major visual quality and aesthetic issues associated with each category.

<u>**Nonrail Alternatives 1, 2, and 3 and 3A**</u>

These options, which are intended to reduce traffic through programmatic or management actions such as increased bus and BART service and/or the construction of new bus and car lanes, relate to visual resources through:

- Minimal changes to the existing landscape/setting (i.e., Alternatives 1 [No Build] and 2 [TSM]) resulting from little or no construction of new facilities.

- Avoidance of dense residential areas along Port Chicago Highway and within the City of Pittsburgh by primarily staying within the existing transportation corridors along State Routes 242 and 4.

<u>**Alternatives 4, 4A, and 5 (LRT)**</u>

Light rail options become a concern in terms of visual impact where:

- Portions would be elevated, potentially disrupting and/or restricting existing views. Generally, elevated facilities would be more visible than at-grade facilities.

- The presence of overhead power supply and support structures required for light rail systems may result in a somewhat cluttered appearance (similar to overhead electrical distribution and telephone lines).

- Light rail routes and facilities would, in some instances, run directly through neighborhoods. The image of light rail mass transit would be generally incompatible with the existing residential neighborhood visual character in these cases.

<u>**Alternatives 6, 7, 7A, and 7B (BART)**</u>

Visual resource issues associated with the BART options include:

- Portions of the BART alternatives where facilities would be elevated, particularly along the south end of Port Chicago Highway, has the potential for disruption or restriction of existing views.

- The image of mass transit facilities, including BART, is generally not compatible with neighborhood settings.

- BART is a recognized and accepted visual element of the local landscape, making the image of BART familiar in a regional sense, particularly along existing freeway systems.

Alternative 8 (BART to North Concord/Martinez; LRT to West Antioch)

This alternative would have the same visual resource issues as previously identified for the BART and LRT alternative segments:

- Portions would be elevated, potentially disrupting and/or restricting existing views. Generally, elevated facilities would be more visible than at-grade facilities.

- The presence of overhead power supply and support structures required for light rail systems may result in a somewhat cluttered appearance (similar to overhead electrical distribution and telephone lines).

- Light rail routes and facilities would, in some instances, run directly through neighborhoods. The image of light rail mass transit would be generally incompatible with the existing residential neighborhood visual character in these cases.

- Portions of the BART alternatives where facilities would be elevated, particularly along the south end of Port Chicago Highway, has the potential for disruption or restriction of existing views.

- The image of mass transit facilities, including BART, is generally not compatible with neighborhood settings.

- BART is a recognized and accepted visual element of the local landscape, making the image of BART familiar in a regional sense.

5.4.2 ALTERNATIVE-SPECIFIC DISCUSSION

Alternative 1 (No Build)

Because this alternative would entail no new development (aside from the development of nonproject-related facilities), the existing setting throughout the study area would generally remain unaffected. An exception may be the sight of increased bus and automobile traffic along State Routes 242 and 4 as compared to the other alternatives. Congested traffic corridors have an associated measure of visual impact.

Alternative 2 (TSM)

Development associated with this alternative would be limited to the construction of park-and-ride facilities near Railroad Avenue and Somersville Road. Neither facility would result in a major change in the existing setting; therefore, any visual impact would not be significant. Construction of these facilities, combined with the alternative's other programmatic measures, should result in lower traffic volumes along State Routes 4 and 242 as compared to Alternative 1. Overall, this alternative is considered visually preferred.

Alternative 3 (HOV to Antioch)

This alternative would involve the construction of two mixed-flow lanes in State Route 242, bus and HOV lanes within the median of State Route 4 and park-and-ride facilities near Railroad Avenue and Somersville Road. The new HOV lanes would result in the presence of constant east and westbound bus and HOV traffic flowing within the median of State Route 4. This would mean the loss of the existing median strip and the introduction of an unusual traffic pattern. Although no significant visual impacts would occur, some visual effect from the loss of the median strip would be likely.

Alternative 3A (HOV to Pittsburg)

The visual impacts from this alternative are similar to those of Alternative 3 (HOV to Antioch). However, the minor visual effect from loss of the median strip in State Route 4 would be less with this alternative.

Alternative 4 (LRT to Antioch)

Significant visual impacts would occur along the southern end of Port Chicago Highway (north of Salvio Street) where light rail facilities would be elevated within the median of the road. Additionally, Port Chicago Highway would be widened in this area to accommodate the tracks. Although it is assumed existing vegetation (which would act as a screen to development) will not be removed, the visual presence of the light rail line would represent a major change in this relatively quiet neighborhood community and would be visible from Port Chicago Highway itself, Mount Diablo Hospital, a portion of John F. Baldwin Park, and a number of the residences along the east and west side of Port Chicago Highway. The light rail station proposed just north of Bacon Street would be visible directly east of the hospital and west of the park. Impacts would continue to occur, but at a somewhat modified level near North 6th Street and beyond as the tracks would no longer be elevated and return to grade, although the presence of structures and wires (as well as occasional trains) would result in some visual impact.

The proposed station at the existing North Concord/Martinez park-and-ride would be visible from the Port Chicago Highway and from residential development to the west (e.g., homes and streets near Sunview Court and Panoramic Drive). However, this facility would not result in a significant visual impact given the current use and image of the existing park-and-ride facility. Panoramic views of Mount Diablo and other areas would not be interrupted by the proposed station.

Along the entire stretch of State Route 4, visual impacts resulting from Alternative 4 would be insignificant. This is because the light rail line and proposed stations would be located in the median or directly adjacent to the existing and proposed portions of State Route 4. Views of facilities from the route and surrounding residential, commercial, and industrial development would be minimally affected (current views are of the route and associated traffic). Long-range views of distant hills or the delta would not be seriously impaired. The addition of a light rail line and associated stations, even with overhead structures and wires, would represent a minor overall change in the State Route 4 viewshed.

Alternative 4A (LRT to West Antioch)

This LRT alternative has similar visual impacts to Alternative 4 except it terminates at Somersville Road. Since Alternative 4 does not have significant visual impacts along State Route 4 east of Somersville Road, the two alternatives are essentially equal.

Alternative 5 (LRT to Antioch via SPTC)

Impacts associated with this alternative would be identical to those previously described for Alternative 4 (LRT to Antioch) west of the Willow Pass Road exit, as both would follow the same Port Chicago/State Route 4 corridor. Significant visual impacts would occur along Port Chicago Highway north of Salvio Street and south of North 6th Street where the light rail line would be elevated within the Port Chicago Highway median.

Significant visual impacts, which are particular to Alternative 5 (LRT to Antioch via SPTC), would also occur along Willow Pass Road where the rail line would diverge from State Route 4. The elevated light rail line within the reconstructed Willow Pass Road median would be visible from portions of residential development (an existing sound wall would screen some views) along the north and commercial development along the south side of Willow Pass as well as to passing motorists travelling east and west. Significant impacts would also occur east of Alves Lane where the elevated line would turn and cross an open area to join with the existing Southern Pacific right-of-way. Here the light rail line and proposed West Pittsburgh station would be visible from residential development which backs onto the existing open area along the north side of Willow Pass Road. Facilities would also be visible from Willow Pass Road itself.

Visual impacts would be below a level of significance along the existing SPTC line right-of-way where the proposed light rail line would proceed east at-grade past Railroad Avenue. Exhibit 5.4-1 provides a graphic image of the West Antioch Station. An elevated portion of the line would be visible along the Pittsburg-Antioch Corridor, but given the current undeveloped character and absence of residential development in the area, impacts would not be significant. Visual impacts would remain relatively insignificant past the Contra Costa County Fairgrounds as the line would continue to follow the existing right-of-way at-grade.

Significant visual impacts would occur from east of G Street to an area just east of A Street. Within this area, an elevated segment of the light rail line and station would be visible from residential and commercial development to the north and south of the existing at-grade right-of-way, and along nearby streets (e.g., Railroad Avenue, Belshaw Street, D Street, and A Street). From A Street eastward, visual impacts would be relatively insignificant as facilities would be built at-grade and adjacent to the existing rail line from this point to the proposed East Antioch light rail station at Hillcrest Avenue. Along this segment, proposed light rail facilities would be generally out of view except from those properties which back up against the existing rail line.

<u>Alternative 6 (BART to North Concord/Martinez)</u>

Impacts associated with this BART alternative would be similar to those identified for the light rail alternatives in the area from the existing Concord BART Station to the Port Chicago/State Route 4 interchange, as this option follows the same corridor. BART tracks and support structures would appear essentially the same as those required for the light rail alternatives, minus the overhead power supply poles and wires. Although the absence of overhead wires and the alternative station sites adjacent to Mount Diablo Hospital would be a visual improvement over the proposed light rail systems, the presence of BART would still represent a major visual change in the area and would be visible from nearby residential development and Port Chicago Highway. Like the light rail alternatives, the most serious visual impacts would occur north of Salvio Street to just south of North 6th Street where proposed facilities would be in an elevated configuration. A graphic image of overhead BART facilities along Port Chicago Highway is provided in Exhibit 5.4-2.

Visual impacts would occur, but would be less serious along Port Chicago Highway for the remaining portion of this alternative. The majority of the BART line from North 6th Street to the proposed North Concord/Martinez station are either underground (undercrossings at North 6th Street and Olivera Road) semidepressed, or at-grade. The line would be slightly elevated generally between Floyd Lane and Ranchito Drive, but not to the degree that it would dominate the views of surrounding residences. The proposed North Concord/Martinez station would be built partially underground and would include the existing park-and-ride facility. Given the present character of the station location and the fact that distant panoramic views to Mount Diablo would not be impaired, visual impacts would be below a level of significance. Finally, the short section of track which would be visible immediately south of State Route 4 at the Port Chicago Highway interchange would result in minimal visual impact given the absence of residential development.

<u>Alternative 7 (BART to Antioch)</u>

The visual impacts of Alternative 7 (BART to Antioch) along Port Chicago Highway would be the same as those described for Alternative 6 (BART to North Concord/Martinez), since both options would follow identical plan and profiles in this area. Where Alternative 7 (BART to Antioch) would continue eastward within the median of State Route 4 (existing and proposed alignments), any negative visual effect would be insignificant given the existing high use transportation character of the corridor. This is true along the entire portion of the route from the State Route 4/Port Chicago Highway interchange to the proposed BART station/service yard at Hillcrest Avenue. While the station/yard would be visible from State Route 4, locating the

Image 1

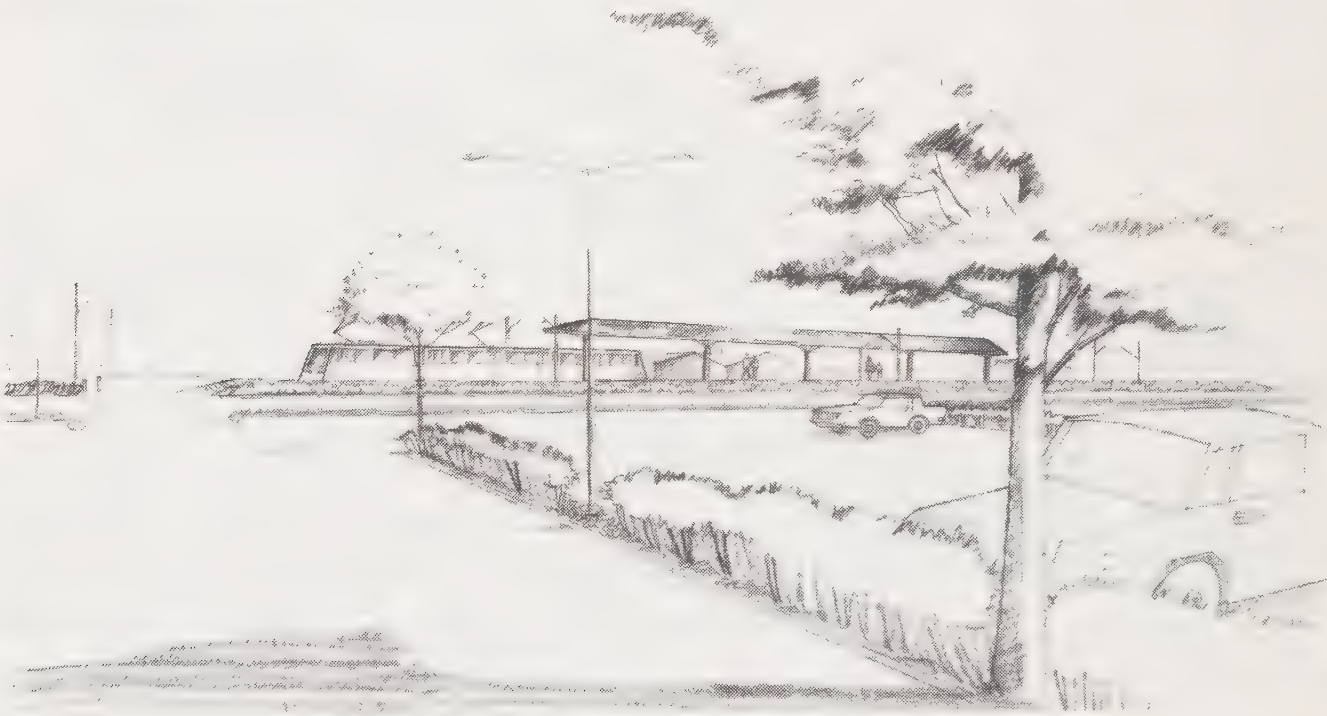


Image 2

Image 1 is a photograph of the existing view toward the site of the West Antioch Light Rail Station taken from Century Boulevard. Industrial development is seen behind the existing SPTC right-of-way.

Image 2 is an artist's sketch of the West Antioch Light Rail Station constructed along the existing SPTC right-of-way. Parking for the new station is shown in the foreground.

Visual Analysis of
West Antioch LRT Station

Pittsburg–Antioch Corridor
AA/DEIR

NO SCALE

BART

Exhibit 5.4–1

Image 1

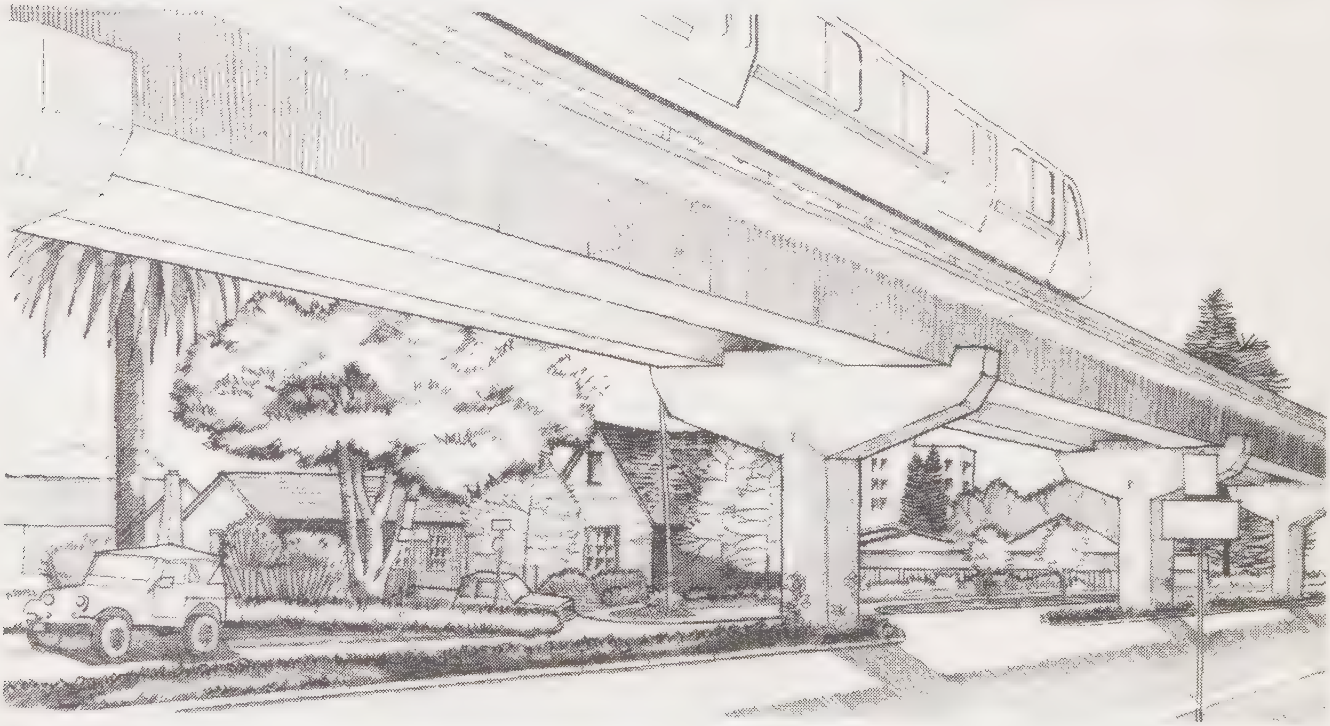


Image 2

Image 1 is a photograph of the existing view along Port Chicago Highway between Salvio Street and Pacheco Street, looking northwest. Residential development is seen on the west side of Port Chicago Highway with Mt. Diablo Hospital in the background.

Image 2 is an artist's sketch of BART facilities in the same location as the photo above. The elevated BART tracks are shown constructed in the newly created median strip.

Visual Analysis of Elevated BART Structure Along Port Chicago Highway

Pittsburg–Antioch Corridor AA/DEIR

BART

Exhibit 5.4–2

facility within this area of light industrial/underdeveloped character would result in a relatively low visual impact. The additional West Pittsburg, Pittsburg, and West Antioch BART stations also would not generate significant visual impacts, as these platforms would be located within the State Route 4 median, and the park-and-ride facilities would be located directly adjacent to the roadway. A graphic image of the Pittsburg BART station is provided in Exhibit 5.4-3. No significant views from surrounding development (of the Delta to the north or ridgeline to the south) would be disrupted or impaired by this alternative.

Alternative 7A (BART to West Pittsburg)

This alternative has similar visual impacts to Alternative 7 up to West Pittsburg. A major visual change would be evident along Port Chicago Highway.

Alternative 7B (BART to Pittsburg)

Alternative 7B visual impacts are very similar to Alternative 7. A major visual change would occur along Port Chicago Highway with insignificant negative visual effects along State Route 4.

Alternative 8 (BART to North Concord/Martinez; LRT to West Antioch)

The BART portion of this alternative is equivalent to Alternative 6 and has a significant visual change along Port Chicago Highway. The LRT portion is similar to Alternative 4A and would represent a minor change to the overall State Route 4 viewshed.

5.4.3 COMPARISON OF ALTERNATIVES

Overall Visually Preferred Alternative

From the standpoint of visual resources, Alternative 2 (TSM) would create the fewest overall negative impacts. This is because the existing visual environment is minimally altered with Alternative 2 aside from nonproject-related development, while at the same time addressing, to some degree, the ever increasing traffic flow within the study area which itself has a negative visual effect. Additional park-and-ride facilities proposed near Railroad Avenue and Somersville Road would be located within relatively open areas presently devoid of residential development, and would be visually compatible with their surroundings.

Visually Preferred Nonrail Alternative

As previously described, Alternative 2 (TSM) is the overall visually preferred alternative. This nonrail alternative was selected over Alternative 1 (No-Build) on the premise that increased transit measures and additional park-and-ride facilities associated with Alternative 2 would be more effective in reducing traffic flows than the No-Build Alternative. Increased traffic flow is considered to be a negative visual impact, thus Alternative 2 was considered the superior option.

Among the nonrail alternatives, Alternative 3 (HOV to Antioch) would create the greatest amount of visual impact, mainly due to the placement of mixed-flow lanes in State Route 242 and east and westbound HOV lanes within the State Route 4 medians. Drivers and viewers may find this arrangement visually distracting.

Visually Preferred Rail Alternative

The BART alternatives (Alternatives 6, 7, 7A, 7B, and 8) would be preferred from a visual standpoint for the following reasons:

- BART rights-of-way and streamlined trains are a relatively familiar sight within the Bay Area; a light rail system and its associated overhead power system would most likely be perceived as less attractive.

- Although both light rail and BART alternatives would affect the John F. Baldwin Neighborhood Park area, the BART alternatives would not include overhead power structures/wires or the light rail station across from the Mount Diablo Hospital. In addition, sections of both BART alternatives would be placed below grade, including crossings at both North 6th Street and Olivera, and a portion of the North Concord/Martinez station.

- The light rail option which utilizes the existing SPTC line right-of-way (Alternative 5) would result in significant visual impacts along Port Chicago Highway, Willow Pass Road, and an area roughly between G and A Streets in Antioch. Only the Port Chicago Highway area would be significantly affected by the BART alternatives.

Between the BART alternatives, neither is clearly preferred since both would affect the Port Chicago Highway area. Although Alternative 7 (BART to Antioch) would extend much farther than Alternative 6 (BART to North Concord/Martinez), the impacts associated with the extension along the State Route 4 median would not be significant. Alternative 7 (BART to Antioch) may be viewed as superior in some aspects, assuming it would be more effective than Alternative 6 (BART to North Concord/Martinez) in reducing traffic (previously identified as a negative visual impact) along the State Route 4 corridor.

5.4.4 MITIGATION MEASURES

1. No measures are available to mitigate the significant visual affects of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 along Port Chicago Highway and Alternative 5 along Willow Pass Road crossover the SPTC line.

5.5 HISTORIC AND CULTURAL SITES

5.5.1 IMPACTS

Archival research and field review have resulted in the identification of no known prehistoric archaeological resources that are located within the study corridor Area

Image 1

Image 2

Visual Analysis of Pittsburg BART Station

Pittsburg–Antioch Corridor AA/DEIR

Image 1 is a photograph of the existing view along eastbound Highway 4 approaching Railroad Avenue. The Railroad Avenue overpass appears in the middle ground.

Image 2 is an artist's sketch of the Pittsburg BART Station in the location shown in the above photo. The station would occupy a median strip created by widening State Route 4.

NO SCALE

BART

Exhibit 5.4-3

of Potential Effect (APE). However, as discussed in Appendix C, some archaeological sensitivity is believed to exist in the downtown Concord area between Concord Avenue and Port Chicago Highway. Similarly, no historic archaeological sites have been identified in the project corridor. However, archaeological sensitivity associated with the Todos Santos Plaza historic district is indicated along Concord Avenue between the existing BART station and Galindo Street. Historic archaeological sensitivity also exists at the Alternative 5 Pittsburg LRT Station in association with the old SPTC Station.

Several historical properties are identified within the vicinity of the project corridor. However, only three are located in an APE (Alternative 5 alignment) that could be affected.

Section 106 of the National Preservation Act requires that project effects on significant archaeological sites and historic properties be addressed. Significant resources are those properties that are listed or are eligible for listing on the National Register of Historic Places. U.S. Department of Interior regulations describe the National Register criteria for listing this way:

> The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and that (a) are associated with events that have made a significant contribution to the broad patterns of our history; or (b) that are associated with the lives of persons significant in our past; or (c) that embody the distinctive characteristics of a type, period, or method of construction, or that possess high artistic values, or that represent a significant distinguishable entity whose components may lack individual distinction; or (d) that have yielded or may be likely to yield information important in history or prehistory (36 CFR Section 60.4, cited in Advisory Council on Historic Preservation 1986b).

For purposes of the alternatives analysis, the historic properties within the APE are tentatively regarded as potentially significant cultural resources subject to direct, adverse impacts. If federal funding is pursued, refinement of the resources inventory would be necessary with the completion of a Section 106 historic properties survey report in which each of the potentially affected resources would be evaluated by the cited National Register criteria. Such a report would be prepared for the preferred project. Recommendations for the completion of that report are detailed in the mitigation discussion.

The impacts from each alternative are discussed individually in the following sections.

<u>Alternative 1 (No Build)</u>

No presently discernible impacts on cultural resources will result from the No-Build Alternative.

Alternative 2 (TSM)

No presently discernible impacts on cultural resources will result from the TSM Alternative.

Alternatives 3 and 3A (HOV to Antioch, HOV to Pittsburg)

No presently discernible impacts on cultural resources will result from the Busway/HOV Lanes to Antioch or to Pittsburg. Concord Avenue is located near the Todos Santos Plaza historic district where several historical structures are situated. However, continued use of the existing roadway would have no adverse effects on the structures. Future right-of-way widening or other improvements could potentially affect some of the identified historic resources. If such improvements include below-ground construction activities between the Concord BART Station and Galindo Street, potentially significant historic archaeological deposits could be discovered. There is also a moderate potential for discovering subsurface prehistoric archaeological sites along Concord Avenue as well; the proximity of archaeological site CA-CCo-19 suggests this potential.

Alternatives 4, 4A, 6, 7, 7A, 7B, and 8 (LRT/BART)

No presently discernible impacts on cultural resources will result from the alternatives along the Port Chicago Highway and State Route 4. However, moderate subsurface prehistoric archaeological sensitivity may exist on the Port Chicago Highway alignment between the existing Concord BART Station and Olivera Drive. Subsurface construction work could lead to the discovery of prehistoric cultural deposits, although there is no reasonable way to determine where or if such a potentially adverse impact may occur. This sensitivity exists for Alternatives (4, 4A, 5, 6, 7, 7A, 7B, and 8) that use the Port Chicago Highway alignment.

Alternative 5 (LRT to Antioch via SPTC)

The LRT to Antioch via State Route 4 and SPTC Railroad Alternative could adversely affect the Southern Pacific Station, and the associated building and movie theatre located in the Pittsburg LRT Station on Railroad Avenue. These structures would have to be moved or demolished in order to develop the proposed LRT station and parking area.

5.5.2 MITIGATION

The known archaeological sites and historic properties in the project area have been documented, and those that could be affected by the project alternatives were identified and presented in the preliminary discussions regarding their significance. Also, areas of probable resource sensitivity were identified. If federal funding is requested, the key element in meeting the Section 106 requirements for the preferred alternative will be the completion of a Historic Properties Survey Report (HPSR) in which the National Register eligibility of all potentially affected resources is determined. Upon the selection of a preferred project, the following procedures are recommended for completing the HPSR.

Archival research should be undertaken to determine the historical significance of potentially affected structures where National Register eligibility is unknown. The appropriate documentation in the form of land title records, city directories, maps, plans, photos, and local and regional histories should be researched to establish the historical context of the resource(s) if National Register criteria (a) or (b) are applied in significance determination. Standard HPSR forms, including photographs, should be completed, and if criteria (c) is applied a detailed architectural evaluation of the structure(s) should be presented. The completed HPSR should include an assessment of impacts on eligible historic properties within the project APE and a discussion of site-specific mitigation programs.

Project-related impacts on significant historical properties could be mitigated by the following alternatives.

1. Avoidance of the historical property through modification of the alignment or construction plans that would allow for the preservation of the resource at its present location. This management program could also include restoration of a structure (or district) to a specific period or theme and preservation with adaptive reuse (perhaps with limited interior modifications).

2. Relocation of the historical structure(s) to a place where it can be preserved.

3. If neither of these mitigation alternatives can be implemented and a historical property may be damaged or destroyed, it is recommended that a "Historic American Building Survey" be accomplished for the structure. Such a procedure involves the precise recording of the structure through measurements, drawings, and photographs. The documentation of the resource is on standardized forms and is accurate in detail to such an extent that after demolition, the historical structure could be reconstructed from the survey data. Copies of the documents should be filed with all appropriate federal, state, and local repositories. This mitigation program could include salvage and selective reuse of building materials and features once the survey is completed.

4. Other less drastic mitigation measures may be appropriate for alleviating minor or temporary impacts on structures. Such measures may be as simple as avoiding the resource by strictly limiting some construction activities close to the building. Monitoring during construction may be included.

An archaeological field survey should be accomplished for the preferred project in those areas that were not surveyed during this preliminary study (see Appendix C, Maps 2 through 7). If previously unknown archaeological sites are discovered, subsurface testing programs should be undertaken to determine the significance of the prehistoric deposits that could be affected by the preferred project. The testing procedures should be designed to specifically determine the boundaries of the site(s), the depositional integrity, and the cultural significance (as per criteria [d] for National Register eligibility) of the resources. These investigations should be conducted by qualified professionals experienced in Contra Costa County prehistoric studies. The testing programs should be conducted within the context of appropriate

research considerations and should result in a detailed technical document that defines the exact project impacts on significant resources and presents comprehensive mitigation program(s) for addressing those impacts.

Project-related impacts on prehistoric archaeological sites could be mitigated by the following alternatives.

1. Avoidance of the archaeological site through modification of the project alignment or construction plans that would allow for the preservation of the resource in its present location.

2. Covering or "capping" the site with a protective layer of fill. This could be a very good way of mitigating potential impacts in situations where BART or LRT tracks will be laid at-grade; protective fill can be placed on the site(s), followed by the track grade and construction. Archaeological monitoring during construction should be required.

3. In circumstances where archaeological deposits cannot be preserved through avoidance or capping, data recovery through excavation would be the recommended mitigation. This measure would consist of the methodical excavation of those portions of the site(s) that will be adversely affected. The work should be accomplished within the context of a detailed research design and in accordance with current professional standards. The program should result in the extraction of sufficient volumes of nonredundant archaeological data so as to address important East Bay research considerations. The excavations should be accomplished by qualified professionals and detailed technical reports should result.

Of great importance in considering subsurface testing and excavations of prehistoric archaeological sites, is consultation with the local Native American community regarding all aspects of the programs, including the treatment of cultural materials and particularly the removal, study, and reinterment of Native American burials. All arrangements concerning these matters should be worked out prior to beginning the archaeological programs.

Regarding historic archaeological resources, detailed archival research in combination with subsurface testing is recommended for the sensitive area surrounding the old Southern Pacific Station and associated building in the proposed LRT station and parking area at Railroad Avenue in Pittsburg. These procedures would be necessary in determining if significant below-ground resources would be affected. Similar procedures are recommended if future road improvements are proposed for Concord Avenue between the existing Concord BART Station and Galindo Street. These investigations should also be conducted within the context of appropriate historical research considerations and should result in a detailed technical document that identifies the location and significance of cultural deposits, defines the exact impacts that will result from project construction, and present a comprehensive mitigation program(s) for the resources. Mitigation alternatives would likely include: (1) avoidance of the resource(s) with preservation in place; (2) covering the site with a protective layer of fill; and (3) data recovery through excavation with similar recommendations as presented for prehistoric sites regarding professional procedures and reporting.

In areas where no known archaeological sites are documented, but where moderate archaeological sensitivity is identified, professional archaeological monitors should observe the subsurface construction in order to prevent or minimize damage to potentially significant cultural deposits that could be exposed during construction. Where sensitivity for prehistoric resources is present, Native American monitors should be involved. In the event that subsurface deposits or features are encountered, construction work in the immediate vicinity of the find should be halted, the proper authorities should be informed, and an appropriate course of action developed that is acceptable to all concerned parties. All such procedures should be conducted within the context of federal, state, and local cultural resources management requirements. In the event that cultural deposits are discovered during unmonitored construction, an archaeologist should be consulted and similar procedures should be implemented.

5.6 PARKLANDS

This section presents the potential effects of each of the transportation alternatives on parklands. The analysis examines both direct effects (i.e., partial or full parkland removal) and indirect effects (i.e., effects resulting from the proximity of an alternative to a parksite of the alternatives).

No facilities construction would take place that would involve the partial or full removal of parkland for Alternatives 1 (No Build), 2 (TSM), or 3 (HOV to Antioch). In addition, no indirect impacts would result from Alternatives 1 or 2 because they would not involve a substantial change in existing conditions. Similarly, Alternative 3 (HOV to Antioch) would not encroach on any parkland sites and would not be significantly visible (Section 5.4), nor significantly raise the noise levels (Section 5.11) at any parkland sites.

Alternatives 4 (LRT to Antioch), 4A (LRT to West Antioch), 5 (LRT to Antioch via SPTC), 6 (BART to North Concord/Martinez), 7 (BART to Antioch), 7A (BART to West Pittsburg), 7B (BART to Pittsburg), and 8 (BART to North Concord/Martinez; LRT to West Antioch) may cause significant direct and indirect effects to parkland sites, and are thus discussed in the following sections by parksite. Table 5.6-1 summarizes the potential impacts.

5.6.1 PORT CHICAGO HIGHWAY BIKE ROUTE

The Port Chicago Highway Bike Route would be affected similarly by Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8. Between the existing terminus of BART and High School Avenue, an approximate 0.5-mile stretch, the alignment would be in the center of the highway. The bike route is along and separated from the east side of the highway; therefore, direct use of the bike path would not be affected by these alternatives in this area.

TABLE 5.6-1

PARKLAND IMPACTS

Parklands	Alternatives 3	3A	4	4A	5	6	7	7A	7B	8
1. Port Chicago Highway Bike Route	(NE)	(NE)	V,U,N (S)	V,U,N (S)	V,U,N (S)	V,U,N (S)	V,U,N (S)	V,U,N (S)	V,U,N (S)	V,U,N (S)
2. John F. Baldwin Neighborhood Park	(NE)	(NE)	V,N (NS)	V,N (NS)	V,N (NS)	V,N (NS)	V,N (NS)	V,N (NS)	V,N (NS)	V,N (NS)
3. Diablo Creek Golf Course	(NE)	(NE)	(NS)	(NS)	(NS)	(NE)	(NS)	(NS)	(NS)	(NS)
4. Ambrose Park	(NE)	(NE)	(V) (NS)	(V) (NS)	(NE)	(NE)	(NE)	(NE)	(NE)	(NS)
5. Pittsburgh City Park	(NE)	(NE)	(NE) (NS)	(NE)	V (NS)	(NE)	(NE)	(NE)	(NE)	(NE)
6. Contra Loma Park	(NE)	(NE)	(NS)	(NE)	(NE)	(NE)	V (NS)	(NE)	(NE)	(NS)
7. Contra Costa District Fairgrounds	(NE)	(NE)	(NE)	(NE)	N,V (NS)	(NE)	(NE)	(NE)	(NE)	(NE)

U - Use of Property
N - Noise
V - Visual
(NE) - No Effect
(NS) - Not Significant
(S) - Significant

Source: Michael Brandman Associates 1988.

The route of the alternatives would indirectly affect bike path use because of visibility and noise levels. The visual impact would not be significant because the bike path is located along a highway that is neither designated as a scenic corridor nor displays the characteristics of one. Therefore, development of any of the alternatives would not significantly detract from the visual characteristics of the bike path.

North of High School Avenue, the route of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 crosses to the east side of the highway and follows this course to State Route 4, approximately 0.75 miles to the north. The bike path would need to be relocated to accommodate this alignment. Therefore, the bike path from High School Avenue north to its terminus near State Route 4 would be directly and significantly affected by development of any of these alternatives. However, the bikeway can be relocated within the existing Port Chicago Highway right-of-way.

The proposed extension of the bike path along the alignment of State Route 4 would not be significantly affected by any of the alternatives, which would either be within the median of State Route 4 (Alternatives 4, 4A, 7, 7A, 7B, and 8) or north of State Route 4 (Alternative 5). None of these alternatives would encroach upon the bike path, if constructed, and would be separated from the route by at least three freeway lanes. Therefore, it would not be indirectly affected by these alternatives.

5.6.2 JOHN F. BALDWIN NEIGHBORHOOD PARK

Like the Port Chicago Highway Bike Route, the John F. Baldwin Neighborhood Park (Baldwin Park) would be affected in the same manner by Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8. This is because the route is in the same location and at the same height for each of these alternatives as it passes near Baldwin Park. The only difference in the alternatives, aside from the fact that Alternatives 4, 4A, and 5 are light rail; Alternatives 6, 7, 7A, and 7B involve BART; and Alternative 8 is a combination of LRT and BART, is that an LRT station would be placed adjacent to, but across two lanes of traffic from, Baldwin Park if Alternative 4, 4A, or 5 is adopted. Regardless, in all other alternatives, the structure would be approximately 50 feet west of the park and approximately 30 feet above ground level in the center median of Port Chicago Highway when it passes the park.

From Baldwin Park, the route would be fairly well screened from the view of park users by a relatively dense screen of trees that are located on the fringe of the park adjacent to the highway. Because access to the park is provided primarily by residential streets, development of any of the alternatives would not encroach upon the use of the park.

Indirectly, potential visual impacts would not be significant due to the vegetative screening previously described.

In addition to the indirect visual effect, Baldwin Park would also experience an increase in noise levels; however, this increase would not significantly affect the use of the park.

5.6.3 DIABLO CREEK GOLF COURSE

Alternative 6 (BART to North Concord/Martinez) would terminate in the northern portion of the City of Concord prior to its entering the State Route 4 corridor. It would thus not pass near the Diablo Creek Golf Course.

Alternatives 4, 4A, 5, 7, 7A, 7B, and 8, because of their location within the center median of State Route 4, would pass within 150 feet of the southern edge of the Diablo Creek Golf Course. Although the structure would be approximately 30 feet above ground level as it passes the golf course, it would not directly affect use of the course. It would not take any golf course land, nor would it inhibit access to the golf course.

Indirectly, these seven alternatives, as viewed from the golf course, may cause visual and noise impacts. For visual resources, the raised structure would be visible against a backdrop of relatively undeveloped hills in the north Concord area. However, the freeway along which the structure would be located would also be visible within the same viewshed. Thus, although the structure would be visible against a relatively undeveloped backdrop, it would not significantly alter the viewshed from this area and would not be considered a significant impact.

5.6.4 AMBROSE PARK

Neither Alternative 5 nor 6 would be located in proximity to Ambrose Park. Alternative 5 is nearly 1 mile north of the park along the SPTC at this location. Alternative 6 terminates in north Concord several miles to the west.

Alternatives 4, 4A, 7, 7A, 7B, and 8 would pass within approximately 100 feet of the park. Structures would be located within the center median of State Route 4, which is adjacent to the park at this point. The route would be at ground level as it passes near the park.

None of these alternatives would require the use of parkland at Ambrose Park, nor would they inhibit access to the park. Therefore, no direct effects to this park would occur. Indirect effects related to visual resources also would not occur, given the structures location at ground level within the center median of a freeway.

5.6.5 PITTSBURG CITY PARK

Of all the alternatives, only Alternative 5 (LRT to Antioch via SPTC) would pass in proximity to Pittsburg City Park. This alternative would pass within 100 feet of the northern boundary of the park as it passes along the SPTC line at ground level. It would be separated from the park by North Parkside Drive. This alternative would not involve the removal of any parkland, nor would it inhibit access to the park. Thus, no significant direct impacts would result.

Indirectly, Alternative 5 (LRT to Antioch via SPTC) would effect visual resources from the park. Overhead structures along the route would be visible from the park, but so would roadways and train tracks used by SPTC. Therefore, the alteration of visual resources from this point would not be considered significant.

5.6.6 CONTRA LOMA PARK

Alternatives 4, 7, and 8 would pass within approximately 100 feet of Contra Loma Park. Structures would be located within the center median of State Route 4, which is adjacent to the park at this point. The structures would be at ground level as it passes near the park.

Alternative 5 (LRT to Antioch via SPTC) would be approximately 0.5 miles north of the park along the SPTC line at this location. Alternatives 4A, 6, 7A, and 7B would terminate prior to reaching this location.

None of the alternatives would require the use of parkland at Contra Loma Park, nor would they inhibit access to the park. Therefore, no direct effects to this park would occur. Indirect effects related to visual resources also would not occur, given the location at ground level within the center median of the freeway.

5.6.7 CONTRA COSTA DISTRICT FAIRGROUNDS

Of all the alternatives, only Alternative 5 (LRT to Antioch via SPTC) would pass in proximity to Contra Costa District Fairgrounds. This route would pass within 100 feet of the southern boundary of the fairgrounds as it passes along the SPTC line at ground level. This alternative would not involve the removal of any of the fairgrounds, nor would it inhibit any access to the park. Therefore, no significant, direct impacts would result.

Indirectly, the alternative would affect visual resources from the fairgrounds. Overhead structures would be visible from the fairgrounds, as are existing roadways and SPTC rail lines. The southern portion of the fairgrounds contains a number of show buildings. Therefore, people would not be in outdoor view of the structures on a frequent basis. The alteration of visual resources from this point would not be considered significant.

5.6.8 MITIGATION MEASURES PROPOSED TO MINIMIZE PROJECT EFFECTS

The only parkland resource that would be significantly affected by any of the proposed alternatives would be the Port Chicago Highway Bike Path, which could be relocated within the existing right-of-way. The following measure would mitigate this impact to a level that is less than significant.

1. If Alternatives 4, 4A, 5, 6, 7, 7A, 7B, or 8 is adopted the Port Chicago Highway Bike Path should be relocated within the existing right-of-way. This can be accomplished by integrating the design of the bike path within the location of facilities.

5.7 PUBLIC SERVICES AND UTILITIES

5.7.1 PUBLIC SERVICES

Police Services

Impacts on the CHP; the Concord, Pittsburg, Antioch, and BART police departments; and the County Sheriff's Department will vary among the seven transit alternatives. Implementation of Alternative 1 would result in a "no build" project, and therefore, no increase in the demand for police services would occur. Implementation of Alternatives 2, 3, and 3A would increase vehicle occupancy along the corridor, reducing the number of potential vehicles traveling along the corridor. A reduction in potential vehicles may result in a reduction of accidents and a potential decrease in the demand for police services. On the other hand, an increase in vehicle occupancy along the corridor would increase the number of vehicles utilizing the park-and-ride lots. An increase in vehicles at park-and-ride lots may result in an increase in vehicle theft and damage, and therefore, the demand for police services may result. These police services would be provided by BART, the CHP, and city and county police departments. Overall, the demand for police services would increase; however, the increase is not expected to be significantly more than with current conditions.

Development of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would result in the construction of a light rail and/or BART system; as a result, the BART Police Department would be responsible for security provisions on the systems and in station areas. Development of Alternatives 4, 4A, 5, 7, 7A, 7B, and 8 would result in a decrease in the number of potential vehicles traveling along the corridor. This decrease in vehicles along the corridor would be greater than under Alternatives 2, 3, and 3A. As a result of the decrease in vehicles, less potential vehicle accidents could occur along the corridor. On the other hand, a greater number of vehicles would use the park-and-ride lot; therefore, a greater potential for vehicle theft and damage could result. Police services for vehicle theft and damage on BART property would be provided by the BART Police Department. Also, additional stations implemented under Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would increase traffic congestion, and parking problems could occur in the areas surrounding additional transit stations. Overall, Alternatives 4, 4A, 5, 7, 7A, 7B, and 8 would increase the demand for the cities, county, BART, and CHP police services.

According to the Concord and Pittsburg police departments, the increase in additional police services as a result of the implementation of Alternatives 4, 4A, 5, 7, 7A, 7B, and 8 would create an adverse impact on their departments and require additional personnel (Lynch 1987; Bagwell 1987). The Antioch Police Department, the Contra Costa County Sheriff's Department, and the CHP have indicated that current levels of service could be maintained if these alternatives are implemented (Lewis 1987; Henderson 1987; Dalecki 1987). The BART Police Department would add personnel, to adequately service the alternatives. BART anticipates to add

approximately nine new personnel under Alternatives 4, 5, 7, and 8. Fewer BART personnel such as a minimum of one officer per three stations, would be added with the implementation of Alternatives 4A, 6, 7A, and 7B. Development of Alternative 6 (BART to North Concord/Martinez) would affect the police services of BART and the City of Concord. The effect on the BART and Concord police departments as a result of Alternative 6 (BART to North Concord/Martinez) would be greater than the impact of Station C (North Concord/Martinez) from Alternatives 4, 4A, 5, 7, 7A, 7B, and 8. A greater number of vehicles would utilize the park-and-ride lot in North Concord with Alternative 6 (BART to North Concord/Martinez) because the station would be at the end of the BART line. As a result, there is a greater potential for vehicle thefts and damages. Traffic congestion would occur at the transit station and greater parking problems could occur in the area surrounding the station. Alternatives 4A, 7A, and 7B also propose the BART or LRT line to terminate before Station K in East Antioch. As a result, a greater effect on the Pittsburg Police Department, which would serve a station at the end of a BART or LRT line, would occur than under Alternatives 4, 5, and 7, which propose the BART or LRT lines to extend to Station K at Hillcrest Avenue in East Antioch. A station at the end of a BART or LRT line would experience more traffic congestion, greater parking problems, and a greater potential for vehicle theft and damages.

As stated previously, the BART Police Department would provide police services for vehicle theft and damage on BART property; however, the city and county police departments would provide traffic and parking enforcement in the area surrounding the stations.

Mitigation Measures

1. The Concord Police Department and the Pittsburg Police Department should increase their personnel to adequately serve Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8.

2. BART police staffing during the construction and operation of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 shall be increased to provide adequate police services along the rail line and at each proposed station.

Fire Protection Services

Implementation of Alternatives 1 or 2 would not result in any construction and would not increase the demand for fire services. Alternatives 3 and 3A (HOV to Antioch, HOV to Pittsburg) would only provide mixed-flow or HOV lanes along State Routes 242 and 4, and therefore, no adverse impacts on fire districts would occur. Development of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, or 8 is not expected to adversely affect the Consolidated Fire District. The existing personnel and facilities are expected to be adequate to serve the potential development of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 (Silva 1987). The Riverview Fire District expects that the development of Alternatives 4, 4A, 5, 7, 7A, 7B, or 8 would result in the need for more manpower within the district. Additional manpower would be needed because several proposed transit stations are located at the extreme eastern and western ends of the district where projected response times for the second responding engine company (and occasionally even the initial responding engine) would be in excess of the district's 5-minute level-of-service goal (Thude 1987).

Mitigation Measures

1. BART shall negotiate a contract for fees with the Riverview Fire District. This fee is in accordance with the current rate for the Riverview Fire District Fire Facilities Element Fees. These fees will mitigate operational costs associated with increased service demands throughout the Riverview Fire District. These fees cannot provide funding for staffing.

2. The implementation of Alternatives 4, 4A, 5, 7, 7A, 7B, or 8 would require additional staffing in the Riverview Fire District. There are no current methods to assess new developments for funds that could be applied to new staffing. Therefore, BART should consult with the Riverview Fire District to ensure adequate response times and staffing responding to emergencies along the corridor and at transit stations.

5.7.2 UTILITIES

Water

As described in Section 3.8.2, several water lines traverse Port Chicago Highway, State Route 4, and the SPTC line. Implementation of Alternatives 3 and 3A (HOV to Antioch, and HOV to Pittsburg) would not affect the Contra Costa Water District facilities in the City of Concord because no construction is proposed in this city. Development of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would result in similar impacts on approximately 10 Contra Costa Water District water lines that traverse or extend along Port Chicago Highway. The Contra Costa Water District also maintains the Contra Costa Canal. The Contra Costa Canal and the Mokelumne Aqueduct, which are maintained by the Contra Costa Water District, traverse State Route 4 and Willow Pass Road between State Route 4 and Port Chicago Highway in West Pittsburg. Implementation of Alternatives 4, 4A, 7, 7A, 7B, or 8 could potentially affect the canal and the aqueduct at State Route 4, while Alternative 5 (LRT to Antioch via SPTC) could affect the canal and aqueduct at Willow Pass Road. Alternative 6 (BART to North Concord/Martinez) does not propose construction outside the City of Concord; therefore, no impacts on the canal and the aqueduct would occur with this alternative.

The City of Pittsburg and the City of Antioch water lines could be affected by the implementation of Alternatives 3 and 3A and Alternatives 4, 4A, 5, 7, 7A, 7B, or 8; however, these potential effects are not expected to be significant if the affected water lines are removed and relocated. Water lines traversing State Route 4 could be affected by Alternatives 4, 4A, 7, 7A, 7B, and 8. Alternative 5 (LRT to Antioch via SPTC) would result in potential effects on water lines traversing the SPTC line. A few of the water lines that are across State Route 4 and the SPTC line extend along a major street that passes over or under these routes. These few water lines would not be affected by the alternatives.

Water demand at the proposed stations is expected to be consumed by bathroom facility or landscaping uses. This demand is expected to be minimal and no adverse impacts on adjacent water lines or water supply is expected.

Mitigation Measures

1. BART shall consult with the Contra Costa Water District, the California Cities Water District, and the cities of Pittsburg and Antioch to determine which water lines, if any, would be required to be removed and relocated as a result of implementing the alternatives.

2. BART shall obtain an easement from the U.S. Bureau of Reclamation over the Contra Costa Canal if Alternative 5 is selected.

Sewer

Development of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 could result in the removal and relocation of sewer lines along the transit corridor. Alternatives 3 and 3A would implement HOV lanes and would not affect sewer facilities in the City of Concord because no construction is proposed in Concord. Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would result in similar potential impacts on sewer lines that traverse or extend along the transit route from the existing Concord Station to State Route 4; however, these potential effects are not expected to be significant if the affected sewer lines are removed and relocated.

The Delta Diablo Sanitary District sewer lines could be affected by Alternative 5 (LRT to Antioch via SPTC). An 8-inch line currently extends along Willow Pass Road and Alternative 5 (LRT to Antioch via SPTC) proposes to extend an aerial LRT rail in the median of Willow Pass Road.

The cities of Pittsburg and Antioch sewer lines could be affected by the development of Alternatives 3, 3A, 4, 4A, 5, 7, 7A, 7B, or 8; however, removal and relocation of the affected sewer lines would reduce the potential effect to a level of insignificance. Similar potential impacts on sewer lines traversing State Route 4 would occur with Alternatives 3, 3A, 4, 7, 7A, 7B, and 8. Alternative 5 (LRT to Antioch via SPTC) would result in potential effects on sewer lines traversing the SPTC line. Some of the sewer lines that extend across State Route 4 and the SPTC line extend along major streets that pass over or under these routes. These sewer lines along these major roads would not be affected by the alternatives.

Sewer generation at the proposed stations is expected to be generated by bathroom facility uses. This generation is expected to be minimal and no adverse impacts on adjacent sewer lines or wastewater treatment facilities are expected.

Mitigation Measures

1. BART shall consult with the cities of Concord, Pittsburg, and Antioch and the Delta Diablo Sanitary District when necessary to remove or relocate sewer lines as a result of implementing the alternatives.

2. BART shall consult with the appropriate agencies to provide sewer services to the stations.

Electricity

Implementation of Alternatives 4, 4A, 5, 7, 7A, 7B, and 8 could affect the major Pacific Gas and Electric electricity lines that are above ground and extend across the transit routes (State Route 4 and the SPTC line). The electricity lines could be affected because these alternatives propose aerial rails in the vicinity of the above-ground electricity lines. The potentially affected major electricity lines include six in the City of Pittsburg and two in the community of West Pittsburg.

Implementation of Alternatives 3, 3A, and 6 would not affect the major aerial electricity lines. Alternatives 3 and 3A (HOV to Antioch, HOV to Pittsburg) would implement Bus/HOV lanes that would be primarily at-grade with a few areas that are below grade such as the on- and off-ramps of State Route 4 at State Route 242. Alternative 6 (BART to North Concord/Martinez) proposes construction in the City of Concord. No major aerial Pacific Gas and Electric electricity lines are currently located in the City of Concord.

In addition to the potential effect on major electricity lines by a few of the rail alternatives, all the rail alternatives could potentially affect minor electrical transmission lines along the corridor. The potential effects to major and minor electricity lines would be determined during final designs.

Mitigation Measures

1. BART shall consult with the Pacific Gas and Electric Company or others to determine which, if any, major and minor electricity lines would need to be relocated.

2. BART shall also consult with the Pacific Gas and Electric Company or others to ensure adequate electrical capacity for the proposed rail alternatives.

Oil

Implementation of Alternatives 3, 3A, 4, 4A, 5, 6, 7, 7A, 7B, and 8 could affect major oil lines within the corridor. Alternatives 3 and 3A (HOV to Antioch, HOV to Pittsburg) could affect a Standard Pacific oil line because this alternative proposes a tunnel for Bus/HOV lanes under the State Routes 242 and 4 interchange. No other oil lines are expected to be affected by this alternative because the additional Bus/HOV lanes are proposed at-grade with the existing highway lanes.

Development of Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would result in a similar potential impact on three oil lines traversing Port Chicago Highway at Olivera Street.

Alternatives 4, 4A, 7, 7A, 7B, and 8 could also affect two additional oil lines: one near Bailey Road and the other at Standard Oil Avenue. Alternative 5 (LRT to Antioch via SPTC) could also affect four additional oil lines: one line along Willow Pass Road to Station E in West Pittsburg and three lines along the SPTC line from Station E to approximately G Street in the City of Antioch.

Mitigation Measure

1. BART shall consult with Union Oil, Getty Oil, Standard Pacific, Shell Oil, and Standard Oil when necessary to relocate major oil lines.

5.8 GEOLOGY, SOILS, AND SEISMICITY

To assess potential impacts of the proposed Pittsburg-Antioch Corridor on the surrounding environment and the impacts on the corridor by the environment, the existing physical conditions related to slope stability, groundwater seepage, compressibility, and seismicity must be considered. For this purpose, the potential impacts and mitigations of the local geology, soils, groundwater, and seismicity are described in this section. Table 5.8-1 summarizes impacts for Alternatives 3 through 8.

5.8.1 GEOLOGY

Potential Impacts

As described in Section 3.9.2, the geologic units within the corridor include unconsolidated to semiconsolidated Younger and Older alluvial deposits and poorly consolidated Tertiary sedimentary rocks. Younger alluvial deposits are often the source of a variety of engineering problems in Contra Costa County. For example, some of the alluvial deposits contain expansive clayey soils which are characterized by high swell and shrinkage potential related to changes in moisture content. These materials usually have low bearing strengths, are relatively more compressible, and are likely to lose strength during an earthquake. Additionally, these alluvial soils contain interstratified, potentially liquefiable sands in the San Francisco Bay Estuary (Contra Costa County Community Development Department [CDD] 1975).

Older alluvial deposits are generally firm and well-drained, and perform satisfactorily as foundation materials (Contra Costa County CDD 1975). However, these materials are subject to erosion and possibly landsliding within the hilly terrain of the study area. For instance, during a field reconnaissance, erosion of cut slopes into an Older alluvial deposit was observed on each side of Port Chicago Highway.

Slope stability in the Tehama and Kreyenhagen formations are related to topography, the orientation of bedding, and the degree of consolidation. Both formations dip generally to the north and northeast. Therefore, on northerly facing slopes, the poorly consolidated rocks of these formations may dip "out of slope" which could cause slope stability problems and/or erosion. Potential slope stability problems in the Tehama and Kreyenhagen formations are also suggested by the presence of small landslides and slumps along State Route 4 (Exhibit 5.8-1) that have moved in a predominantly northerly direction. Evidence of existing slope failure within these

TABLE 5.8-1

COMPARISON OF GEOLOGIC IMPACTS FOR ALTERNATIVE ALIGNMENTS

Alternative	Slope Stability (Landslides and Erosion)	Groundwater Seepage Potential	Compressibility/ Shrink/Swell	Seismic-Ground Shaking, Surface Rupture, Liquefaction	Grading Requirements
3/ 3A	Moderate to high potential for erosion and landslides related to adverse bedding and weakly consolidated rocks. Moderate potential at North Concord/ Martinez, West Pittsburg and West Antioch Stations. Good stability at Mt. Diablo, Pittsburg and East Antioch Stations.	Generally low, possibly high in local drainage areas. Moderate to high at Mt. Diablo and West Pittsburg Stations, low at North Concord/ Martinez, Pittsburg, West Antioch and East Antioch Stations.	Generally low, possibly high in soils along Port Chicago Highway. Moderate to high at Mt. Diablo, Pittsburg and West Antioch Stations, low to moderate at the East Antioch Station and West Pittsburg Stations, and variable at the North Concord/ Martinez Station.	High ground shaking and high to low liquefaction potential along Port Chicago Highway, and Antioch, respectively. High potential for surface rupture where alignment crosses Concord Fault along Concord Avenue, and possibly the Antioch Fault in Antioch.	Requires an estimated 20,000 cubic yards of imported fill. Haul routes could disrupt traffic flow. Stability and erosion impacts from grading operations (see other columns).
4	Moderate to high potential for erosion and landslides, related to bedding and poor consolidation. Moderate at North Concord/ Martinez, West Pittsburg, West Antioch Stations. Stability generally good at Mt. Diablo, Pittsburg, and East Antioch Stations.	Generally low, possibly high in local drainage areas or where excavation encounters high water table. Moderate to high at Mt. Diablo and West Pittsburg Stations, low at North Concord /Martinez, Pittsburg, West Antioch and East Antioch Stations.	Generally low, possibly high in soils along Port Chicago Highway. Moderate to high at Mt. Diablo, Pittsburg and West Antioch Stations, low to moderate at the West Pittsburg and East Antioch Stations, and variable at the North Concord/Martinez Station.	High ground shaking and high to low liquefaction potential along Port Chicago Highway and in Antioch, respectively. High potential for surface rupture where alignment crosses Antioch Fault in Antioch.	Requires disposal of an estimated 200,000 cubic yards of cut material. Involves a large quantity of grading. Haul routes could disrupt traffic flow. Stability and erosion impacts from grading operations (see other columns).
4A	Same as Alternative 4 except LRT terminates at Somersville Road and therefore does not cross the Antioch Fault.				

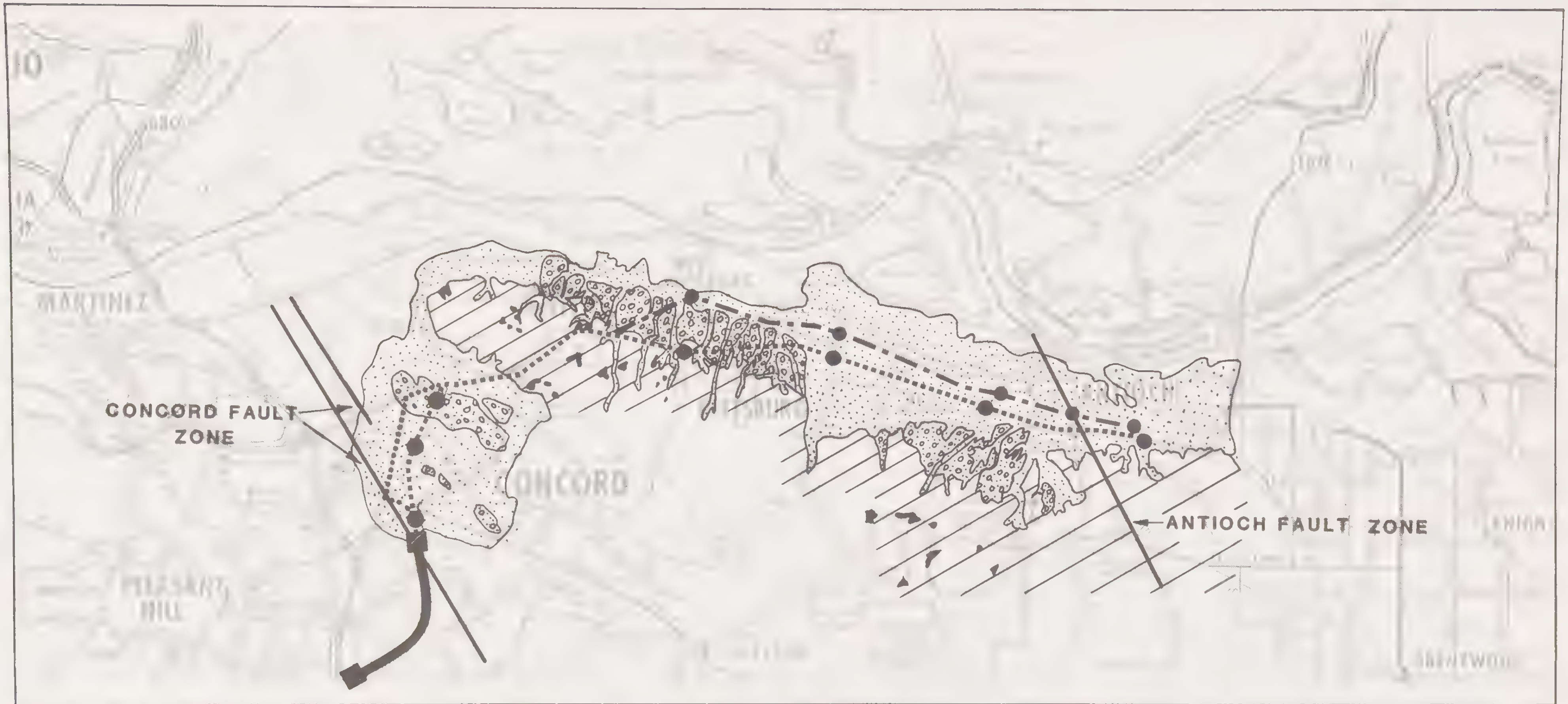
TABLE 5.8-1 (Continued)

Alternative	Slope Stability (Landslides and Erosion)	Groundwater Seepage Potential	Compressibility/ Shrink/Swell	Seismic-Ground Shaking, Surface Rupture, Liquefaction	Grading Requirements
5	Moderate to high potential for erosion and landslides, related to bedding and poor consolidation. Generally good stability at Pittsburg, Mt. Diablo, Antioch and East Antioch Stations. Moderate to high potential at North Concord/Martinez and West Antioch Stations, and low at West Pittsburg Station.	Moderate to high along Port Chicago Highway, and in West Pittsburg. High where excavation encounters high water table. Moderate to high at Mt. Diablo, West Pittsburg and Pittsburg Stations, low at North Concord/ Martinez, West Antioch, Antioch and East Antioch Stations.	High along Port Chicago Highway and West Pittsburg. Moderate to high at Mt. Diablo, West Pittsburg, West Antioch and Antioch Stations, low to moderate at the East Antioch Station, and variable at the North Concord/Martinez Station.	High to very high ground shaking and high to low liquefaction potential along Port Chicago Highway and Antioch, respectively. Moderate ground shaking and liquefaction potential at West Pittsburg and Pittsburg Stations. Low liquefaction potential at Antioch and East Antioch Stations (due to estimated deep water table). High potential for ground rupture at Antioch Station.	Requires an estimated 195,000 cubic yards of imported fill. Haul routes could disrupt traffic flow. Stability and erosion impacts grading operations (see other columns).
6	Good stability, some erosion potential near the Industrial Highway intersection and the North Concord/Martinez Station. Moderate to high potential for erosion and landslides related to bedding and poor consolidation.	Possibly high along parts of Port Chicago Highway. Moderate to high at the Mt. Diablo Station, low at the North Concord/Martinez Station. Potentially high where excavation encounters high water table.	Possibly high along parts of Port Chicago Highway. Moderate to high at the Mt. Diablo Station; variable at the North Concord/Martinez Station.	High ground shaking and liquefaction potential.	Requires disposal of an estimated 40,000 cubic yards of cut material. Involves smallest quantity of grading of the alternatives. Haul routes could disrupt traffic flow. Stability and erosion impacts from grading operations (see other columns).
7	Moderate to high potential for erosion and landslides related to bedding and poor consolidation. Moderate at North Concord/ Martinez, West Pittsburg, West Antioch Stations. Stability generally good at Mt. Diablo, Pittsburg and East Antioch Stations.	Generally low, possibly high in local drainage areas or where excavation encounters high water table. Potential may be higher than alternatives 4 and 5 due to deeper excavation required for BART foundations. Moderate to high potential at Mt. Diablo and West Pittsburg Stations, low at North Concord/Martinez, Pittsburg, West Antioch and the East Antioch Stations.	Generally low, possibly high in soils along Port Chicago Highway. Moderate to high at Mt. Diablo, Pittsburg and West Antioch Stations; low to moderate at the West Pittsburg and East Antioch Stations, and variable at the North Concord/Martinez Station.	High ground shaking and high to low liquefaction potential along Port Chicago Highway and in Antioch, respectively. Possible high potential for surface rupture where alignment crosses Antioch Fault in Antioch.	Requires disposal of an estimated 210,000 cubic yards of cut material. Involves largest quantity of grading of the alternatives. Haul routes could disrupt traffic flow. Stability and erosion impacts from grading operations (see other columns).

TABLE 5.8-1 (Continued)

Alter-native	Slope Stability (Landslides and Erosion)	Groundwater Seepage Potential	Compressibility/ Shrink/Swell	Seismic-Ground Shaking, Surface Rupture, Liquefaction	Grading Requirements
7A	Same as Alternative 7 except terminates at Baily Road and therefore does not cross the Antioch Fault.				
7B	Same as Alternative 7 except terminates at Railroad Avenue and therefore does not cross the Antioch Fault.				
8	Same as Alternative 4 to North Concord/Martinez and Alternative 7 continuing on to Antioch.				

Source: Geo Resources Consultants, Inc. 1988.



SOURCE: DIBBLEE, THOMAS W., 1980, 1981; NELSEN, TOR H., 1971, 1973; SPECIAL STUDIES ZONE MAPS OF PORT CHICAGO, WALNUT CREEK, ANTIOCH NORTH, AND ANTIOCH SOUTH QUADRANGLES, CALIFORNIA, DIVISION OF MINES GEOLOGY. 1974, 1976, 1977.

Legend

RECENT (YOUNGER) ALLUVIUM
(correlates with Zone II seismic response)

PLEISTOCENE (OLDER) ALLUVIUM
(correlates with Zone I seismic response)

PLIO-PLEISTOCENE AND EOCENE TEHAMA AND KREYENHAGEN FORMATIONS
(correlates with Zone 0 or I seismic response)

LANDSLIDE

SPECIAL STUDIES FAULT ZONES

Geologic Map
Pittsburg–Antioch Corridor
AA/DEIR

North

0 1.5 3 MILES

BART

Exhibit 5.8-1

formations was observed along the southern side of State Route 4 during a site reconnaissance. Areas of potential slope instability due to slumping or erosion are interpreted from available geologic maps and field reconnaissance, and are shown in Exhibit 5.8-2.

Mitigation Measures

In the course of construction within the corridor, the upper portion of younger alluvial deposits may need soil improvement for any type of foundation support. Measures such as over-excavation and replacement with engineered fill may be considered for foundation support. However, these measures may not entirely mitigate potential settlement and soil-swelling problems at depth and it may be advisable to install flexible joints within the critical structures of the corridor facilities to allow for such vertical movements.

The selected alignment and associated facilities should be positioned away from the toe of any cut slopes according to the Uniform Building Code or as recommended by geotechnical consultants. To further mitigate the impacts of slope instability in older alluvial deposits and Tertiary bedrock on the corridor, slope stabilization measures at the toe of slopes as recommended by geotechnical consultants should be provided. To mitigate the effects of erosion, a number of methods may be used, including revegetation, grading only during the dry season, terracing, and landscaping techniques.

It should be stressed that any cut-and-fill slopes proposed for the new construction should be designed for appropriate steepness so that slope stability may be maintained and surface erosion be minimized. Proper surface and subsurface drainage should be incorporated in the design of new slopes.

Weak or fractured bedrock can be mitigated through use of special foundation types, construction methods, retaining wall types, or modified structural design. Adverse bedrock conditions may exist in weakly consolidated or highly fractured sedimentary rocks. These conditions have been considered and eliminated as potential adverse impacts in the layout and construction of State Route 4, the Port Chicago Highway, Willow Pass Road, and the Southern Pacific Railroad corridor. However, construction of a rail alternative will require additional cuts into bedrock and foundation design may need to be modified.

5.8.2 SOILS

Potential Impacts

Some soils underlying the corridor may be particularly compressible or subject to erosion. Engineering properties of underlying soils are described in Section 3, Table 3.9-1. Soils likely to be most problematic are delineated in Exhibit 5.8-3. It is anticipated at this time that some of these soils will be used as fill or exposed in cut slopes. Potential impacts include settlement of fills, fill/cut slope failure, and increased erosion of cut-and-fill slopes.

Mitigation Measures

The presence of compressible and expansive soils may preclude direct foundation support. These soils should be replaced by properly compacted engineered fill for foundation, subgrade, and pavement support. Alternatively, the foundation may be deepened to underlying lower firm soils below the zone of moisture changes. Revegetation and landscaping should be initiated where erodible soils are exposed at the crest of cut slopes and along drainages that cross the corridor. Diversion of drainage away from faces would also help mitigate erosion. The design of proper cut-and-fill slopes (stable inclination relative to material involved) requires a slope stability analysis. Unstable cut slopes may require retaining walls, while fills need to be compacted for anticipated loads. Consolidation testing should be performed to get a time-rate of settlement, so it can be incorporated into the design of overlying structures.

Comparison of grading requirements for Alternatives 3, 3A, 4, 4A, 5, 6, 7, 7A, 7B, and 8 indicates some differences in cut-and-fill volumes (Table 5.8-2). Alternatives 4, 4A, 6, 7, 7A, 7B, and 8 along State Route 4 would likely generate excess fill material. This fill material would need to be disposed of at an appropriate site. Routes would have to be established to haul the fill, so as to minimize interferences with regular traffic. Alternative 7 (BART to Antioch) and 8 (BART to North Concord/Martinez; LRT to West Antioch) would generate the largest volume of cut-and-fill (790,00 cubic yards). This is primarily due to the more extensive foundation grading required for the BART structures, stations, and trackways. The BART line must pass over or under route interchanges and street intersections, whereas the LRT route (Alternative 4) can cross level with highways in some locations. Alternatives 3 (HOV to Antioch) and 5 (LRT to Antioch via SPTC) would likely require imported fill for foundation grading.

5.8.3 GROUNDWATER

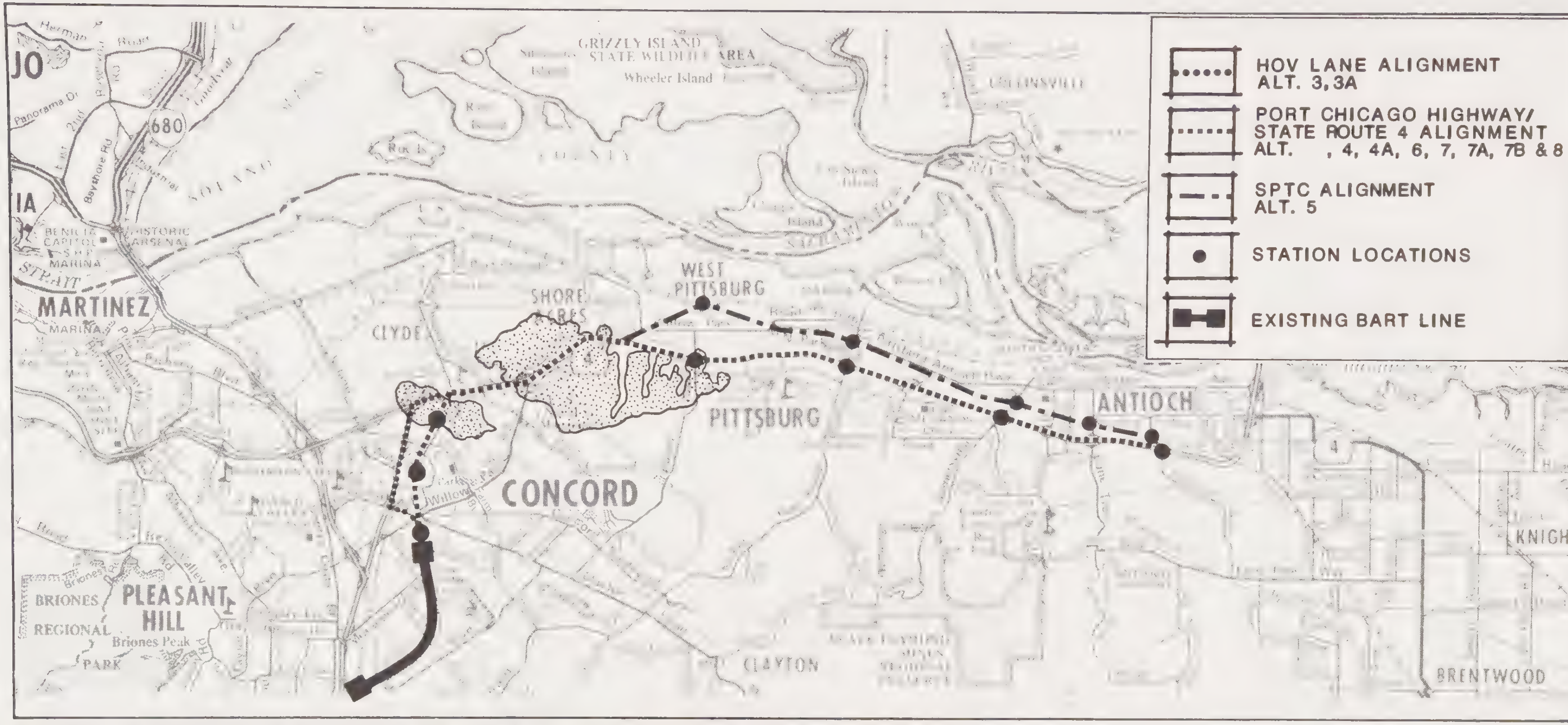
Potential Impacts

Shallow groundwater may occur along Port Chicago Highway where perched conditions may underlie Conejo and Clear Lake soils (Spare 1987). Shallow groundwater may also occur along State Route 4 where localized marshlands occur. Exhibit 5.8-4 delineates potential high water table zones within the corridor.

It is anticipated that most of the selected alignments and associated facilities will be constructed above ground and, therefore, groundwater seepage should not present a problem during corridor construction or operation. However, excavation for foundations may require deep cuts into bedrock or soils where groundwater may be present. Alternative 7 (BART to Antioch) will require the most extensive and deepest excavation because BART requires more complex geometrics.

Mitigation Measure

If groundwater seepage does occur and affects corridor facilities, it may be necessary to implement a temporary or permanent dewatering program in areas of excavation to allow for earthwork construction.



SOURCE: INTERPRETED FROM DIBBLEE, THOMAS W., 1980, 1981: NILSEN, TOR H., 1971, 1973.

Areas Of
Potential Slope Instability
Pittsburg–Antioch Corridor
AA/DEIR

Legend

AREAS OF POTENTIAL SLOPE INSTABILITY

North 0 1.5 3 MILES

BART

Exhibit 5.8-2

SOURCE: DEPT. OF AGRICULTURE, 1977 AND FROM EARTH SCIENCES ASSOC., 1976

Legend

HIGH SHRINK-SWELL POTENTIAL

Includes soils of the:

Antioch Series (Abd)
Capay Series (CaA, CaC)
Clear Lake Series (Cc)
Conejo Series (CeA, ChA)
Diablo Series (DdD)

HIGH EROSION POTENTIAL

includes soils of the:

Antioch Series (AbE)
Diablo Series (DdE, DdF)
Rincon Series (RbD)

Lq: LIQUEFACTION POTENTIAL MAY BE HIGH IN SOME PLACES

Ag: LOW LIQUEFACTION POTENTIAL

Ls: LANDSLIDE TERRAIN, LIQUEFACTION UNLIKELY

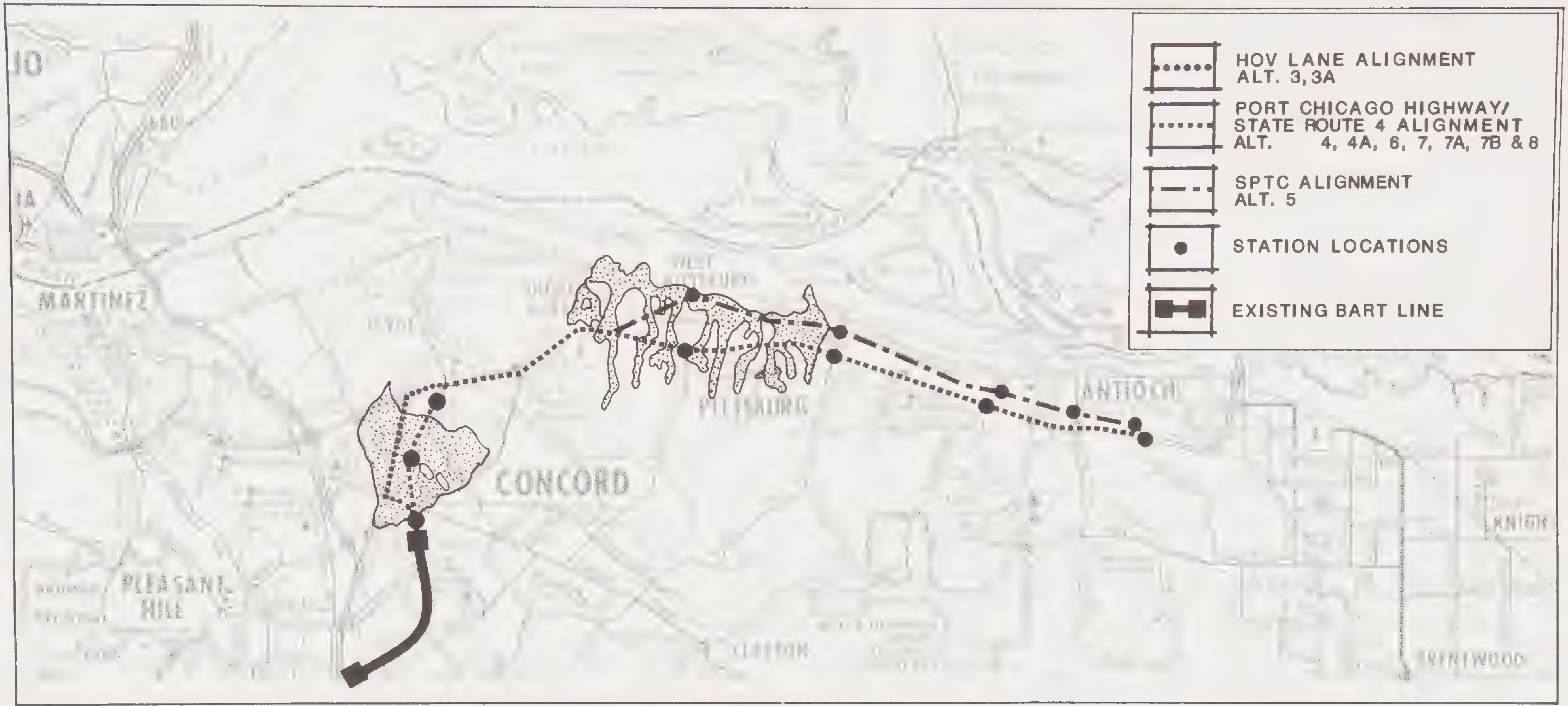
Soil Distribution Map

Pittsburg–Antioch Corridor AA/DEIR

North 0 1.5 3 MILES

BART

Exhibit 5.8-3



SOURCE: INTERPRETED FROM CONVERSATIONS WITH PERSONNEL AT CONTRA COSTA COUNTY DEPARTMENT OF HEALTH SERVICES

Areas Of Potential High Water Table

Pittsburg-Antioch Corridor AA/DEIR

Legend

AREAS OF POTENTIAL HIGH WATER TABLE

North

0 1.5 3 MILES

BART

Exhibit 5.8-4

TABLE 5.8-2

GRADING REQUIREMENTS FOR ALTERNATIVES
(Cubic Yards)[a]

Alternative	Excavation	Fill
3	360,000	380,000
3A	290,000	155,000
4	475,000	275,000
4A	305,000	195,000
5	180,000	375,000
6	60,000	20,000
7	500,000	290,000
7A	210,000	90,000
7B	240,000	140,000
8	500,000	290,000

a Source: Bechtel Civil, Inc. 1988.

5.8.4 SEISMICITY

Potential Impacts

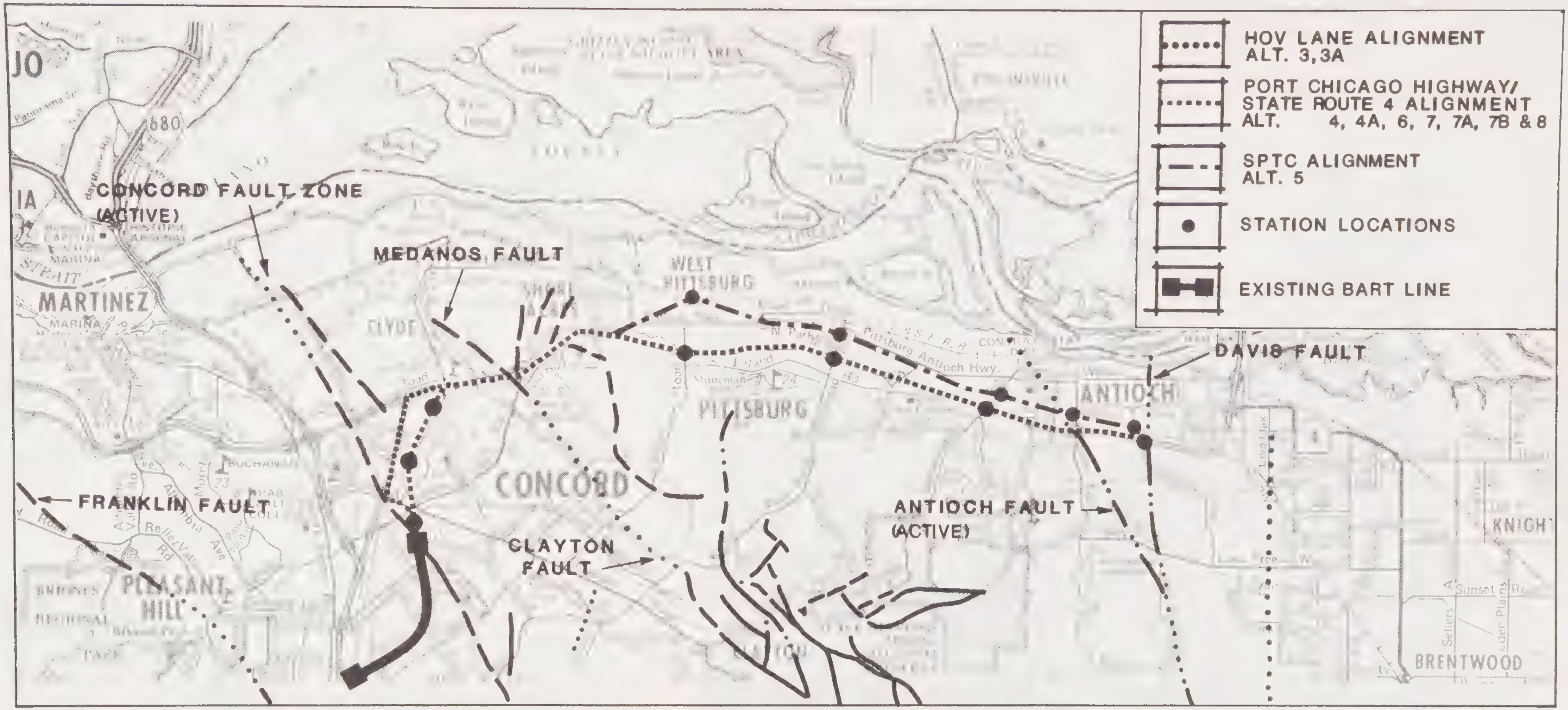
The corridor is located within a seismically active area that could be affected by fault rupture or associated ground shaking and liquefaction. The proximity of the corridor to important regional and local faults is shown in Section 3, Exhibits 3.9-1 and 3.9-2 and in Exhibits 5.8-1, 5.8-5, and 5.8-6.

Faults located within the corridor but not expected to affect the alternative alignments include the Davis Fault, the Medanos Fault, and other unnamed faults (Exhibit 5.8-5). The Davis Fault extends northward from its intersection with the Antioch Fault to about State Route 4. Its trace runs through the potential East Antioch Yard approximately 2,000 feet from the East Antioch Station. Since the Davis Fault was shown in a USGS publication to tie in with the Antioch Fault, there was concern that the Davis Fault may be active (Department of Water Resources [DWR] 1978). The DWR conducted a fault study for the Davis Fault in 1978. However, their area of interest was south of the Antioch-Davis Fault intersection. Trenching across the fault just north of Balfour Road revealed that the fault may offset soils estimated to be 200,000 years old and is overlain by undisturbed soils ranging from 50,000 to 100,000 years old (DWR 1978). Therefore, this fault is not considered to be active by the California Division of Mines and Geology.

The Medanos Fault crosses State Route 4 in the Willow Pass area. It is not considered to be an active fault (Earth Sciences Associates 1976). Other mapped, unnamed faults within the study area are relatively short in length and are probably not seismically significant.

The Concord Fault passes through the entrance to State Route 242 from Concord Avenue where the Alternative 3 (HOV to Antioch) alignment is proposed (Exhibit 5.8-5). As shown in Table 5.8-3, the surface rupture potential along the Concord Fault is estimated to be 1 to 4 feet. Since the Concord Fault is a strike-slip fault it is probable that the surface rupture would be predominantly in a horizontal rather than vertical direction (Sharp 1973). Therefore, in the event of such rupture, it is not anticipated that the alignment would be significantly affected although disruption of traffic flow would likely occur.

As shown in Exhibits 5.8-1, 5.8-5, and 5.8-6, the Antioch Fault passes through Alternatives 3, 4, 5, 7, and 8 and possibly crosses the potential LRT Antioch Station (Alternative 5 only). This is a significant potential impact because the trackways of all these alternatives will cross the fault, and may possibly be subject to unavoidable surface rupture.



SOURCE: CONTRA COSTA COUNTY COMMUNITY DEVELOPMENT DEPARTMENT,1975

Faults Map

Pittsburg–Antioch Corridor
AA/DEIR

Legend

FAULT LOCATION

APPROXIMATE FAULT LOCATION

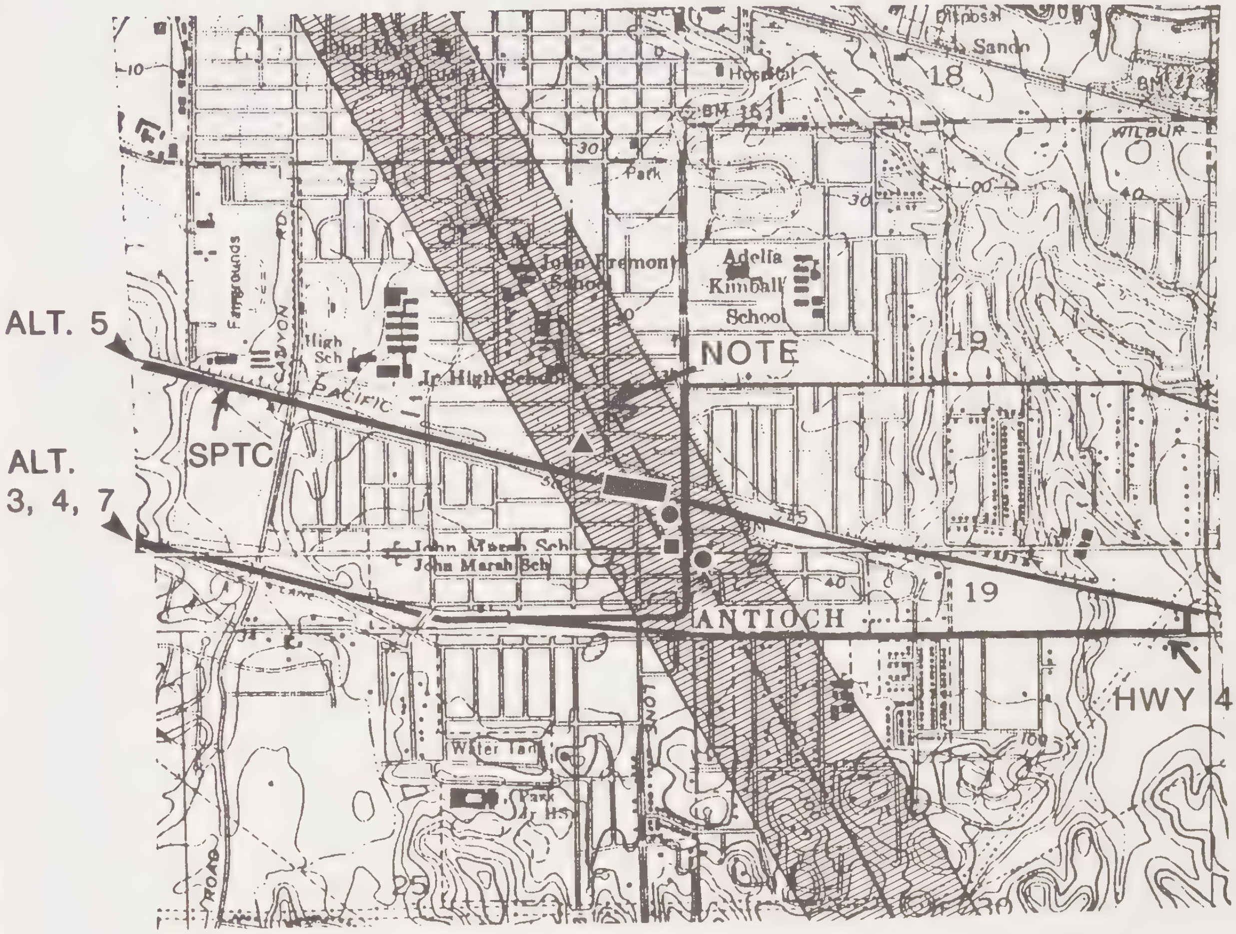
FAULT LOCATION UNCERTAIN

North

0 1.5 3 MILES

BART

Exhibit 5.8–5



NOTE: Fault Trace Extended From Trace On "Antioch South Special Studies Zone Map"

Legend

- APPROXIMATE LOCATION OF POTENTIAL LRT STATION ON SPTC ALIGNMENT (ALTERNATIVE 5)
- APPROXIMATE LOCATION OF TRENCH EXCAVATION BY ENEGO, 1978
- APPROXIMATE LOCATION OF TRENCH EXCAVATED BY HARDING LAWSON, 1978
- APPROXIMATE LOCATION OF TRENCHES EXCAVATED BY BURKLAND AND ASSOCIATES, 1975
- ANTIOCH FAULT TRACE
- ANTIOCH SPECIAL STUDIES ZONE BOUNDARY

Location of the Corridor Alignments Relative to the Antioch Fault

Pittsburg-Antioch Corridor AA/DEIR

North

0 1000 2000 FEET

BART

Exhibit 5.8-6

TABLE 5.8-3

KNOWN ACTIVE FAULT
DESIGN CONSIDERATIONS[a]

	San Andreas Fault	Hayward and Calaveras Faults	Concord and Green Valley Faults	Antioch[b] Fault
Estimated Magnitude (Richter scale)	7 to 8.25	6 to 7.5	6 to 7	5.5
Estimated Fault Offset (feet)	4 to 30	1 to 8	1 to 4	1 foot
Estimated Duration Strong Shaking (seconds)	24 to 37	5 to 30	5 to 24	--
Estimated Length of Tectonic Rupture (miles)	40 to 300	5 to 70	5 to 25	--
Estimated Peak Horizontal Acceleration in Bedrock (g's)[c]	.10 to .25	.10 to .25	.10 to .30	.20 to .30

a Taken from Contra Costa CDD 1975.
b Taken from Burkland and Associates 1975.
c Based on design data from Contra Costa CDD 1975 and distance of causative fault from corridor.

Source: Geo Resources Consultants, Inc. 1988.

Previous fault investigations have been conducted by several geotechnical firms in the area of the potential Antioch Station (Alternative 5). The locations of these investigations are shown in Exhibit 5.8-6. Estimates of surface rupture along the Antioch Fault have been suggested by Burkland and Associates (1975). Based on an earthquake magnitude 5.5 or higher, they estimate that surface rupture of up to 1 foot may occur along the fault. Burkland and Associates has recommended that human occupancy buildings be prohibited within a zone extending 25 feet on either side of the fault trace identified in their study. However, the Antioch Fault is not well defined in terms of its location and seismic activity. Fault trench data gathered from various geotechnical studies in the Antioch vicinity are conflicting; some investigations found little or no evidence of the fault on or close to its projected trace, while other studies found possible evidence of active faulting away from the main trace. Additionally, the Antioch Fault trace, as defined on the Alquist-Priolo maps, is somewhat conjectural since the trace does not match when the two quadrangles are set adjacent to each other (Exhibit 5.8-6). Additional subsurface data are needed to fully assess potential surface rupture.

Faults that could affect the corridor by earthquake-related ground shaking or liquefaction are the San Andreas, Hayward, Calaveras, and Concord faults (see Exhibits 5.8-1, 5.8-5, and 5.8-6). The ground shaking and liquefaction susceptibility of rock and soil types are very closely related. Table 5.8-3 summarizes ground shaking impacts for Alternatives 3, 4, 4A, 5, 6, 7, 7A, 7B, and 8. Ground shaking is generally high in relatively loose, granular material and becomes less severe in increasingly consolidated materials. Liquefaction is a form of ground failure that occurs when cohesionless, saturated, granular material loses strength in response to ground shaking.

Soil characteristics and water level data have been used to group the various geologic terrains into three zones according to their predicted ground shaking and liquefaction susceptibility during a great earthquake originating from the San Andreas Fault or a moderate earthquake originating from a major fault in Contra Costa County (Contra Costa County CDD 1975). The three zones describe areas of low susceptibility (Zone 1), moderate susceptibility (Zone II), and high susceptibility (Zone III). In general, Zone I consists mainly of Older alluvium and Pliocene bedrock (such as the Tehama Formation). Zone II includes areas underlain by Younger alluvium and Zone III includes the sediments of the San Francisco Bay Estuary and Delta Lowland. Pre-Pliocene bedrock shows very low to zero response to ground shaking and liquefaction. Liquefaction potential is highest in water saturated, clay-free sands (Contra Costa County CDD 1975).

The susceptibility zones previously described are correlated with the occurrence of geologic units along the corridor and are delineated in Exhibit 5.8-1. The geologic materials that underlie the corridor either have zero to very low response potential (bedrock) or fall under Zone 1 or Zone II categories. Younger alluvium (Zone II) underlies most of Alternative 6 and much of Alternatives 3, 4, 4A, 5, 7, and 8 in the cities of Pittsburg and Antioch. It is extensive along Alternative 5 in the West Pittsburg and City of Pittsburg area. Younger alluvial deposits also underlie portions of Alternatives 3, 4, 4A, 7, 7A, 7B, and 8 in the West Pittsburg area. Younger alluvium underlies the proposed Diablo Hospital, West Pittsburg (Alternative 5 only), Pittsburg, and Antioch stations. Holocene alluvium consists mainly of unconsolidated floodplain deposits of clay, silt, and gravel (Sims et al. 1973). The highest ground shaking and liquefaction potential within the corridor probably occurs along the

SPTC alignment (Alternative 5) in the West Pittsburg area and along State Route 242 and Port Chicago Highway in Concord where water-saturated, unconsolidated Holocene (Younger) alluvium is predominant.

The City of Concord has also evaluated liquefaction potential within its city limits. Exhibit 5.8-3 delineates zones according to specific engineering properties. The zone designated "LQ" consists of stiff alluvial clay with local sand and silt lenses. Liquefaction potential may be high in some areas within this zone. The area designated "Ag" appears to correspond with older alluvial deposits shown in Exhibit 5.8-1, and is not susceptible to liquefaction. The area designated "LS" is not considered to be susceptible to liquefaction; however, this terrain may be susceptible to landsliding (Earth Sciences Associates 1976).

Mitigation Measures

Seismic parameters for faults that could affect the corridor by ground shaking or liquefaction are listed in Table 5.8-3. These parameters should be incorporated into the design of the potential alignment and associated facilities.

The design of structured foundations should incorporate potential effects of ground shaking or liquefaction. "Life critical" structural elements (stations, structures, and trackways) should be designed to resist strong ground movements from maximum credible earthquakes. This will require using stronger materials and possibly deeper foundations than would be necessary to support only static loads. Though discrete lenses of susceptible soils may not pose a significant problem for the foundation support, extensive zones below the foundation may require mitigation. Soil densification measures such as dynamic ground modification or vibroflotation methods may be considered. Alternatively, deeper foundation support may alleviate the problem. Additionally, seismic soil response characteristics should be included in the foundation design to provide adequate lateral resistance.

The effect of soil liquefaction on slopes should also be addressed. Slope instability during an earthquake could be mitigated by reducing the slope height, steepness, and/or improving the soils by proper compaction and drainage.

Before construction, subsurface investigation will be needed in areas of potential liquefaction to identify the vertical and horizontal extent of loose granular soils above and below the water table. In areas where such conditions are encountered, mitigation measures could include compaction of soils, installation of a dewatering system, or construction of pilings or caissons.

Potential surface rupture from a large magnitude earthquake occurring on either the Concord (Alternative 3 [HOV to Antioch]) or Antioch faults (Alternatives 3, 4, 5, 7, and 8) may involve vertical and horizontal offsets of 1 or more feet, and should be considered in the design of the system. There is no adequate method of mitigation for surface rupture along trackway crossings; however, the BART system employs a monitoring system to warn when potentially damaging earthquakes occur. Because of the proximity of the Antioch Fault to the Antioch Station proposed along Alternatives 4, 5, and 7, it is recommended that subsurface (trenching) investigations be performed in the area of the proposed Antioch Station. Based on the results of the subsequent subsurface investigation, engineering modifications may be required.

Trackways should also be designed to accommodate for fault creep, a slow but measurable surface movement. As an example, the present BART line through the Berkeley Hills will allow some repositioning of the tracks when necessary because of the creep along the Hayward Fault.

In summary, more studies are needed to establish movement rates, maximum credible fault displacements, and locations of potential surface rupture along the Antioch Fault.

Potential surface rupture along the Concord Fault is not anticipated to significantly affect Alternative 3 (HOV to Antioch). Therefore, mitigation measures are not proposed.

5.8.5 EXISTING DISPOSAL SITES

Potential Impacts

As discussed in Section 3.9.6, three sanitary landfills are located in Contra Costa County. These disposal sites are located in Richmond, Martinez, and Antioch. The sanitary landfill closest to the proposed Pittsburg-Antioch Corridor is the Contra Costa County Waste Sanitary Landfill in Antioch, which is approximately 2 miles south of State Route 4. It is not anticipated that these sites will be affected by or will affect the potential alternative alignments or associated facilities.

Mitigation Measures

No mitigation measures are anticipated.

5.9 ECOSYSTEMS

This section discusses potential impacts on ecosystems from the proposed transportation facilities. Also discussed are potential project impacts on wetland resources protected under Executive Order 11990 and U.S. Department of Transportation Order 5660.1A, and to endangered species under Section 7 of the Endangered Species Act. Potential impacts on vegetative habitats, wildlife populations, and wetland habitats were assessed for significance in accordance with the Council on Environmental Quality regulations. This assessment evaluated the context and intensity of the impacts, including consideration of the setting (local or regional) and the duration of the impacts.

5.9.1 POTENTIAL IMPACTS ON VEGETATION

Potential impacts on vegetation were assessed with respect to the amount of disturbance likely to occur in natural vegetative habitats and the relative value (with respect to local quality and regional distribution) of the habitat types potentially lost. The freshwater/riparian habitats that would be affected are generally of low habitat value because they are small in area, restricted to ditches and irrigation drainages, and are surrounded by urban and agricultural lands. Individual areas that would be affected are generally less than 1 acre. The grassland habitats that would

be affected also represent isolated, disturbed areas dominated by nonnative species and are of low habitat value. No threatened or endangered plant species or other sensitive plant species were observed in the project corridors and no impacts on any sensitive plant species are expected. The alternative alignments are along existing transportation corridors resulting in minimal disturbance of natural plant communities. Therefore, impacts on vegetative communities from any of the alternatives are not expected to substantially diminish the quality of local habitats or have substantial affects on regional plant communities. These potential impacts will not be significant for any of the project corridors.

Alternative 1 (No Build)

No impacts on vegetation are expected.

Alternative 2 (TSM)

No impacts on vegetative communities are expected to result from the implementation of this alternative.

Alternative 3 (HOV to Antioch)

No significant impacts on vegetative communities are expected to result from the implementation of HOV lanes to Antioch.

Alternative 3A (HOV to Pittsburg)

No significant impacts on vegetative communities are expected to result from the implementation of HOV lanes to Pittsburg.

Alternative 4 (LRT to Antioch)

No significant impacts on vegetative communities are expected to result from this alternative.

Minor disturbance of a stream riparian zone may occur at State Route 4 and Mount Diablo Creek. This disturbance would be limited to a raised bridge over the stream riparian zone.

The parking lot for the proposed West Antioch LRT Station is adjacent to the Contra Costa Canal. The canal supports some riparian vegetation. Construction may affect this riparian zone.

Alternative 4A (LRT to West Antioch)

No significant impacts on vegetative communities are expected to result from this alternative and impacts will be identical to those described for Alternative 4.

Alternative 5 (LRT to Antioch via SPTC)

No significant impacts on vegetative communities are expected to result from this alternative.

This alternative would result in the minor disturbance of several riparian marshes (generally less than 1 acre per site) at rail crossings, including a bridge at State Route 4 and Mount Diablo Creek. This alternative would result in the greatest disturbance of wetland sites, but should remain under 10 acres of total disturbance.

The parking lot for the proposed West Antioch LRT Station is adjacent to the Contra Costa Canal. The canal supports some riparian vegetation. Construction may affect this riparian zone.

This alternative would cross a large grassland lot where the line approaches the SPTC line from State Route 4. This grassland does not represent a substantial biological resource because it is disturbed and supports primarily nonnative grasses.

Alternative 6 (BART to North Concord/Martinez)

No significant impacts on vegetative communities are expected to result from this alternative.

Alternative 7 (BART to Antioch)

No significant impacts on vegetative communities are expected to result from this alternative.

Alternative 7A (BART to West Pittsburg)

No significant impacts on vegetative communities are expected.

Alternative 7B (BART to Pittsburg)

No significant impacts on vegetative communities are expected to result.

Alternative 8 (BART to North Concord/Martinez; LRT to West Antioch)

No significant impacts on vegetative communities are expected to result from this alternative and impacts will be identical to those described for Alternative 4.

Mitigation Measures

The mitigation measures required to compensate for disturbance of vegetative communities are basically restricted to sound construction and revegetation practices. No additional mitigations are anticipated because the impacts will be minor. Several practices that should be followed include:

- Limit the area of construction to the minimum possible amount.
- Provide mulch or other temporary soil stabilization techniques on steep slopes that have been cleared by construction until revegetation is complete.

- Avoid the removal of large trees and established areas of shrubs when possible. These vegetative components provide roosting sites for birds and cover for other wildlife.

- Revegetate with native plant species that are suitable for the newly created habitat. A monitoring program should be developed to ensure that revegetation efforts are successful and reimplemented if revegetation goals are not met within a reasonable time.

- Mitigations specific to the freshwater aquatic/riparian vegetation community are given in Section 5.9.3.

5.9.2 POTENTIAL IMPACTS ON WILDLIFE

Potential impacts on wildlife were assessed with respect to the value of the habitat that would be lost for each alternative relative to the known and anticipated wildlife species that utilize these habitats. The freshwater aquatic/riparian and grassland communities that would be affected are generally of poor habitat quality for wildlife species because they are small in size, disturbed, surrounded by existing development, and provide very limited forage and cover. No threatened or endangered or other sensitive wildlife species were observed in the project corridors and no impacts on sensitive wildlife species are expected. The alternative alignments are located along existing transportation corridors, minimizing the disturbance of wildlife habitat. None of the habitats that would be affected are important for animal movement and these disturbances should not adversely affect regional wildlife populations. Some minor behavioral disturbance and mortality (primarily in reptiles, birds, and small mammals) will occur during construction, but these disturbances would not limit local wildlife populations. Therefore, these potential project impacts will not be significant for any of the project corridors. Each of the alternatives is discussed in the following paragraphs.

Alternative 1 (No Build)

No impacts on wildlife are expected.

Alternative 2 (TSM)

No impacts on wildlife communities are expected to result from the implementation of Alternative 2.

Alternative 3 (HOV to Antioch)

No significant impacts on wildlife communities are expected to result from the implementation of HOV lanes to Antioch.

Alternative 3A (HOV to Pittsburg)

No significant impacts on wildlife communities are expected to result from the implementation of HOV lanes to Pittsburg.

Alternative 4 (LRT to Antioch via SPTC)

No significant impacts on wildlife communities are expected to result from this alternative.

Construction of a bridge over Mount Diablo Creek at State Route 4 would cause some temporary disturbance of wildlife that utilize that portion of the riparian corridor. This disturbance would be minor and recovery is expected to occur a short time after construction stops.

Alternative 4A (LRT to West Antioch)

No significant impacts on wildlife communities are expected to result from this alternative and impacts will be identical to those described for Alternative 4.

Alternative 5 (LRT to Antioch via SPTC)

No significant impacts on wildlife communities are expected to result from this alternative.

This alternative would have the greatest impact on wetland wildlife species because it would disturb the greatest amount of wetland habitat. The habitat that would be affected is of low value to wildlife. Temporary disturbance and long term losses of this small amount of habitat are not expected to adversely affect local wildlife populations.

The large grassland lot near the connection of State Route 4 to the SPTC line that would be disturbed does not provide valuable wildlife habitat because of its state of disturbance and the limited forage and cover it provides.

Alternative 6 (BART to North Concord/Martinez)

No significant impacts on wildlife communities are expected to result from this alternative.

Alternative 7 (BART to Antioch)

No significant impacts on wildlife communities are expected to result from this alternative.

Alternative 7A (BART to West Pittsburg)

No significant impacts on wildlife communities are expected.

Alternative 7B (BART to Pittsburg)

No significant impacts on wildlife communities are expected to result.

Alternative 8 (BART to North Concord/Martinez; LRT to West Antioch)

No significant impacts on wildlife communities are expected to result from this alternative and impacts will be identical to those described for Alternative 4.

Mitigation Measures

The mitigations required to compensate for disturbance of wildlife communities are basically restricted to sound construction and revegetation practices. No additional mitigations are anticipated because the impacts will be minor. Refer to specific mitigation measures in Sections 5.9.1 and 5.9.3 for more detail.

5.9.3 POTENTIAL IMPACTS ON WETLANDS

Potential impacts on wetlands were assessed with respect to the amount of disturbance likely to occur in wetland habitats and the relative value (with respect to local quality and regional distribution) of the wetlands that would be disturbed. Potential regulatory requirements (e.g., U.S. Army Corps of Engineers [COE] Section 404 permitting) were also considered. The potential impacts on wetland habitats have been described in Section 5.9.1 and are expected to be not significant. The corridor alternative alignments would not result in significant disturbance to wetlands. Wetland disturbance and filling would occur at some ditch, canal, and stream crossings and in some drainages that run alongside the existing SPTC line. One drainage supporting cattails along the SPTC line covers an area of approximately 1.25 acres. This drainage and most of the other wetlands occur along the alignment for Alternative 5 (LRT to Antioch via SPTC) (Section 3, Exhibit 3.10-1). Because the potential exists for affecting wetlands greater than 1 acre in size, a predischarge notification to the COE should be completed prior to beginning construction. The CDFG should also be notified in compliance with potential Section 1601 permitting.

Alternative 1 (No Build)

No impacts on wetlands are expected.

Alternative 2 (TSM)

No impacts on wetland habitats are expected to result from the implementation of TSM.

Alternative 3 (HOV to Antioch)

No significant impacts on wetland communities are expected to result from the implementation of HOV lanes to Antioch.

Alternative 3A (HOV to Pittsburg)

No significant impacts on wetland communities are expected to result from the implementation of HOV lanes to Pittsburg.

Alternative 4 (LRT to Antioch)

No significant impacts on wetland communities are expected to result from this alternative.

Minor disturbance of a stream riparian zone by bridge construction may occur at State Route 4 and Mount Diablo Creek. Construction disturbance is expected to be less than 1 acre and of short duration. Net loss of riparian habitat is expected to be minor.

A parking lot for the proposed West Antioch LRT Station on State Route 4 is adjacent to the Contra Costa Canal. This parking lot could have some effect on riparian growth along the canal.

Alternative 4A (LRT to West Antioch)

No significant impacts on wetland communities are expected to result from this alternative and impacts will be identical to those described for Alternative 4.

Alternative 5 (LRT to Antioch via SPTC-A)

No significant impacts on wetland habitats are expected to result from this alternative.

This alternative would affect the greatest amount of wetland habitat. Total disturbance is expected to be less than 10 acres; some individual sites may be greater than 1 acre. The potential need for Section 404 (COE) or Section 1601 (CDFG) compliance is greatest with this alternative.

A parking lot for the proposed West Antioch LRT Station on the SPTC line is adjacent to the Contra Costa Canal. This parking lot could have some affect on riparian growth along the canal.

Alternative 6 (BART to North Concord/Martinez)

No significant impacts on wetland habitats are expected to result from this alternative.

Alternative 7 (BART to Antioch)

No significant impacts on wetland habitats are expected to result from this alternative.

Alternative 7A (BART to West Pittsburg)

No significant impacts on wetland habitats are expected.

Alternative 7B (BART to Pittsburg)

No significant impacts on wetland communities are expected to result.

Alternative 8 (BART to North Concord/Martinez; LRT to West Antioch)

No significant impacts on wetland communities are expected to result from this alternative and impacts will be identical to those described for Alternative 4.

Mitigation Measures

The mitigations required to compensate for disturbance of wetland communities primarily include sound construction and wetland restoration practices. Few additional mitigations are anticipated because the impacts will be minor; however, the Section 404 (COE) or Section 1601 (CDFG) permit process may require development of a detailed mitigation and monitoring plan outlining replacement of lost or damaged wetland resources. Potential wetland mitigation measures include:

1. Avoid operation of construction equipment in wetland habitats.

2. Use mulch or other erosion control techniques as appropriate to limit sedimentation in wetland or aquatic habitats.

3. Cross stream riparian zones perpendicular to the course of the stream (the current design already incorporates this measure).

4. Build bridges off the streambank and out of the riparian zone whenever possible. This will effectively reduce or eliminate potential wetland impacts at some sites.

5. Allow for revegetation of wetland habitats with native wetland species. In many cases, minor drainages will be disturbed or filled. Construction will either reroute these drainages or produce new depressions that will support wetland vegetation. Cattails and willows will tend to naturally colonize these drainages. Careful construction planning will ensure that grades are appropriate in new drainages to allow for revegetation by these species.

6. Several larger drainages (supporting cattail marshes) may be disturbed or filled along Alternative 5 (LRT to Antioch via SPTC). Those areas greater than 1 acre should be replaced. The present drainages occur alongside the SPTC line. A new drainage would have to be designed to replace this drainage. The new drainage could be relocated to run alongside the new transportation corridor. Proper design of such a drainage would allow for natural colonization by wetland species (such as cattails) that would compensate for the lost wetlands. Section 404 (COE) or Section 1601 (CDFG) permitting may require replanting to ensure adequate replacement of lost wetland habitats.

5.9.4 SUMMARY OF IMPACTS ON ECOSYSTEMS

No significant impacts on ecosystems are expected to occur from any of the proposed alternatives. The alternative alignments are along existing transportation corridors, thus minimizing the disturbance of natural habitats. Some disturbance would occur in grasslands, but these grasslands are primarily composed of nonnative species, are already in various states of disturbance, and provide limited forage and cover for wildlife species. Several small areas of freshwater aquatic/riparian habitat (primarily cattails and willows) would be disturbed during new route construction. This wetland disturbance will generally be minor and confined to crossings at drainage ditches, streams, and irrigation canals. The greatest disturbance to wetlands would occur with Alternative 5 (LRT to Antioch via SPTC), which may result in the fill of several wetlands that are between 1 and 2 acres in size. These wetlands occur alongside the existing SPTC line and are not of substantial wildlife value because they are linear in nature and are surrounded by developed land. None of the alternatives are expected to result in the total filling of more than 10 acres. Compliance with potential Section 404 permitting (COE) and Section 1601 permitting (CDFG) may be required. No threatened or endangered species or other sensitive biological resources are expected to be affected by the proposed project.

5.10 HYDROLOGY AND WATER QUALITY

5.10.1 SURFACE WATER

Impacts on the surface water quality resulting from operation of the project will be primarily related to increased run-off from paved areas and the decrease in the natural groundcover. In addition, the increased paved areas will carry oils, gasoline, organics, and sediments into the surrounding creeks, streams, and eventually Suisun Bay. However, because these are relatively small and do not substantially contribute to the overall paved areas in the study area, operation of the alternatives is not expected to cause significant adverse impacts.

5.10.2 GROUNDWATER

No direct significant adverse impacts on groundwater resources are expected to occur during operation under any of the proposed alternatives because water will be supplied by municipal water utilities.

5.10.3 FLOODPLAINS

Segments of the rail alternatives will be in areas prone to the 100-year flood, as shown on Exhibit 3.11-2. Operation of the rail segments in the floodplains should not be affected by the 100-year flood and should also not alter the capacity of the floodplain due to project engineering design considerations. The project design will reference applicable federal and local guidelines for flood control as discussed in Section 3.11.1 of this report. For this reason, no significant adverse impacts are anticipated for 100-year floodplain areas.

5.10.4 MITIGATION MEASURES

No significant adverse impacts on surface water, groundwater, and floodplains would result from the implementation of the alternatives; therefore, no mitigation measures are necessary.

5.11 NOISE AND VIBRATION

5.11.1 IMPACT MEASURES AND METHODOLOGY

There are several types of noise and vibration sources associated with rail and motor vehicle transit systems that must be addressed in the environmental impact analysis for construction and operation of new transit facilities. The Pittsburg-Antioch Corridor Study includes, in addition to the No-Build and TSM, an HOV alternative, two primary LRT alternatives, two primary BART alternatives, and an alternative combining both BART and LRT. In the environmental impact analysis, the rail systems are usually more critical and for this reason receive primary attention.

Alternative 1 (No-Build) analysis evaluates the impact of projected changes in local and highway traffic. The results of this analysis become a baseline against which to compare the other alternatives. The alternatives (TSM) would result in noise impacts due to modifications in traffic flow, and local and regional bus operations. Changes in motor vehicle traffic patterns must be substantial in order to produce noticeable changes in a community's noise environment. Addition of a great number of buses to local streets or even moderately travelled highways can produce a significant noise impact, but this does not usually occur to the same degree as for a rail transit system. For the alternatives which require major new structures to operate, construction noise and vibration are also issues that must be considered.

With HOV Alternatives 3 and 3A, the primary consideration is for additional noise from express buses that will operate mostly in special freeway lanes. Either a large increase in bus traffic compared to the amount of other heavy vehicles or a lightly travelled highway would be necessary for a noticeable change in the adjacent community noise environment to occur.

The rail alternatives possess the greatest potential for vibration impact. The analysis of the rail alternatives considers operational noise and vibration due to individual train passbys and the cumulative noise exposure from frequent train passbys. With rail transit systems there are also local noise sources associated with ancillary facilities and stations.

The general approach to assessment of wayside noise and ground-borne vibration impact is to predict the expected levels of both phenomena based on measured data for the same or similar transit system facilities. Prediction of wayside noise is more routine than prediction of ground-borne vibration, due to the complexity of vibration propagation in soil. Ground-borne vibration prediction models require knowledge of transit system properties and site soil characteristics. Fortunately, data are available for both LRT and BART vehicle vibration and propagation characteristics for sites near the corridor area.

The prediction of maximum wayside noise levels for modern transit systems is fairly well developed. Reasonably accurate predictions are possible given reliable baseline noise data and a knowledge of the operational characteristics of the system (e.g., vehicle speeds, number of cars per train). At a particular location, the cumulative effect of numerous train passbys is a function of train headways and the existing level of ambient noise at that location.

For commercial areas, noise from transit train operations is primarily a daytime consideration. In residential areas, noise from trains can be problematic during evening and nighttime, when the community ambient noise level is generally lowest. Obviously, a passby noise level of a given magnitude is more objectionable in a quiet residential area at night than in a busy commercial area during the day.

The APTA Design Guidelines criteria for "absolute" levels due to individual train passby account for differences in community areas by setting acceptable levels based on the type of land use and existing noise exposure levels. The UMTA Assessment Guidelines criteria are expressed in terms of "relative" changes in existing ambient noise exposure levels due to the addition of transit train noise, and automatically account for site-specific ambient conditions.

To assess the noise and vibration impacts for each of the Pittsburg-Antioch Corridor project alternatives, the expected levels from rolling stock, maintenance and yard operations, auxiliary equipment, feeder transit systems, and ancillary facilities have been examined and compared with existing ambient levels and the appropriate criteria. Projections were made of the expected airborne noise and ground-borne vibration levels from train operations on aerial and at-grade ballast and tie sections. Special attention was placed on identifying potential impacts on noise sensitive land uses including residences, schools, hospitals, and other medical facilities.

5.11.2 TRANSIT SYSTEM OPERATIONAL IMPACTS

Noise and vibration levels from operation of rail systems depend on several factors. In general, rail system operational noise and vibration are a function of distance from receiver to the tracks, vehicle speed, type of track support structure (e.g., aerial structure), number of vehicles in a train, and, for noise exposure, the frequency of train passbys (inversely proportional to train headway). Other factors that can directly affect noise levels at a distance from the rail vehicle source are natural or constructed barriers and noise from existing local sources that will combine with transit noise. Predictions of noise and vibration were based on measured noise and vibration LRT data from the Guadalupe Corridor Project in Santa Clara County and data for the BART system.

For surface and aerial installations, one of the most important design features of the rail system, which contributes to quieter operation than may be expected based on previous experience with steel wheel/rail systems, is the use of "continuous welded rail." With continuous welded rail eliminating the rail joints, which are one of the major sources of noise in a steel wheel/rail system, and considering all of the features included on the transit cars for noise reduction, the overall result is a considerably lower wayside noise level than for older systems. Existing BART track uses continuous welded rail as do most all modern systems. LRT track will also have continuous welded rail.

For the purpose of assessing the environmental impact of proposed rail alignments, it is sufficient to assume level terrain for the surrounding community and generally ignore any shielding offered by intervening buildings or existing sound barrier walls between the rail alignment and noise sensitive receivers. This is a conservative assumption consistent with the level of analysis at this stage of the project. A more detailed analysis shall be performed during the engineering design phase of the project to determine the specific details of the noise reduction features indicated in the environmental impact analysis.

For each of the major alternatives, a summary of predicted noise levels at selected critical locations is presented in Table 5.11-1. The noise level predictions contained in Table 5.11-1 are all for locations where a sound barrier wall may be needed. It can be seen that at some locations a sound barrier alone is not sufficient. These situations are discussed in more detail in the following paragraphs. Full details of the prediction methodology and complete wayside noise level predictions for all sections of the various alignments are contained in the Technical Report on Noise and Vibration (see Appendix D).

Predicted ground-borne vibration levels are based on past measurements made adjacent to BART aerial structure, at-grade ballast and tie track, and subway (for cut-and-cover sections) facilities. LRT vibration levels are based on design data for the Guadalupe Corridor project. No predictions for ground-borne noise are necessary because all but short sections of track are at-grade or on aerial structure, and airborne wayside noise should dominate in these instances. Although sufficiently accurate for the purpose of impact analysis, the predictions of ground-borne vibration are estimates and require refinement in the engineering phase of the project. Measurements of site soil and building characteristics are needed to more accurately determine details of vibration reduction features.

<u>Aerial Structure Operation</u>

Concrete deck and all-concrete aerial structures effectively reduce wayside and in-car noise over older, all-steel structures, as they have in the existing modern BART, Washington Metropolitan Area Transit Authority (WMATA) and Metropolitan Atlanta Rapid Transit Authority (MARTA) rail transit systems. It is also possible to use a low (nominally 3.5 to 4 feet above top-of-rail) sound barrier wall to reduce wayside noise further, since the noise is primarily radiated from the underside of the transit car and at the contact point of the vehicle wheels and rail. Therefore, the predictions for wayside noise include, where needed for reduction, a sound barrier wall design, which is standard for the transit industry, as part of the way structure facilities.

In certain situations a sound barrier wall alone is not sufficient to adequately reduce wayside community noise levels. Such a situation usually arises when there are residential community areas close to the alignment that are otherwise shielded from heavy surface street traffic noise by an intervening row of houses. Aerial structure operation raises the transit vehicle noise sources above the first row of houses, thereby eliminating any shielding effects. In such instances, sound-absorbing material applied to the inside face of the sound barrier wall has been found to produce further reductions of wayside noise.

TABLE 5.11-1

SELECTED AMBIENT AND PROJECT-RELATED WAYSIDE NOISE DATA FOR PITTSBURG-ANTIOCH CORRIDOR PROJECT

Station Number	Transit Structure	Type and Quantity of Noise Sensitive Buildings	Distance to Nearest Track (feet)	Passby Noise Criterion (dBA)	Existing Condition (1988) L_{eq} (dBA)	Existing Condition (1988) L_{dn} (dBA)	Predicted Operational Noise Levels* (2000) Passby (dBA)	Predicted Operational Noise Levels* (2000) L_{eq} (dBA)	Predicted Operational Noise Levels* (2000) L_{dn} (dBA)
ALTERNATIVE 4 (LRT to Antioch via Highway 4)									
40+00/51+00 (OB)	A	Residential (16)	50	75	62-64	64-66	70-73	64-66	66-68
40+00/51+00 (OB)	A	Residential (16)	200	75	54-56	55-57	61-64	56-58	57-59
84+00/114+00 (OB)	B&T	Residential (44)	25	75	62-64	64-66	71-74	64-66	66-68
390+00/393+00 (OB)	B&T x-over	Residential (4)	125	80	64-66	68-70	71-74	66-68	70-72
391+00/397+00 (IB)	B&T x-over	Elementary School	200	75	62-64	66-68	67-70	64-66	66-70
ALTERNATIVE 5 (LRT to Antioch via Highway 4 and SPRR)									
352+00/360+00 (IB)	A	Residential (14)	75	75	59-61	61-64	71-74	60-62	64-66
589+00/595+00 (IB/OB)	B&T x-over	Residential (18)	75	75	56-58	58-60	74-77	58-60	60-63
770+00/792+00 (OB)	B&T	Residential (36)	50	75	57-59	59-61	70-73	61-63	61-63
ALTERNATIVE 6 (BART to North Concord/Martinez)									
40+00/51+00 (OB)	A	Residential (16)	50	75	62-64	64-66	78-80	68-70	67-69
40+00/51+00 (OB)	A	Residential (16)	200	75	54-56	55-57	71-73	60-62	59-61
91+50/95+00 (OB)	B&T	Residential (6)	25	75	62-64	64-66	78-80	68-70	67-69
95+00/107+00 (OB)	B&T x-over	Residential (20)	25	75	62-64	64-66	84-86	72-74	70-72
107+00/116+00 (OB)	B&T	Residential (9)	20	75	62-64	64-66	80-82	69-71	68-70
ALTERNATIVE 7 (BART to Antioch via Highway 4)									
40+00/51+00 (OB)	A	Residential (16)	50	75	62-64	64-66	76-78	66-68	67-69
40+00/51+00 (OB)	A	Residential (16)	200	75	54-56	55-57	69-71	59-61	58-60
91+50/95+00 (OB)	B&T	Residential (6)	25	75	62-64	64-66	76-78	66-68	67-69
107+00/116+00 (OB)	B&T x-over	Residential (20)	25	75	62-64	64-66	82-84	69-71	68-70
95+00/107+00 (OB)	B&T	Residential (9)	20	75	62-64	64-66	78-80	67-69	67-69
387+00/395+00 (OB)	B&T x-over	Residential (10)	125	80	64-66	68-70	77-79	68-70	70-72
391+00/397+00 (IB)	B&T x-over	Elementary School	200	75	62-64	66-68	74-76	66-68	68-70
431+00/476+00 (IB/OB)	A	Residential (155)	100	80	65-67	69-71	75-77	67-69	70-72

A = Aerial
B&T = Ballast & Tie
IB = in-bound
OB = out-bound
x-over = crossover
L_{eq} = L_{eq} (peak hour)
* = with sound barrier wall on way structure
Passby = Maximum passby level

The wayside noise level predictions for the aerial structure segments of the alignments do not include the effect of such sound absorption treatment. Where additional reduction in wayside noise may be needed, such areas are addressed in the discussion of each alternative. The specific details and requirements of absorptive treatment and lengths of sound barrier wall sections are to be addressed within the scope of the engineering analysis of the alternative selected for design and construction.

At-Grade Ballast and Tie Track

With ballast and tie operations there is a small decrease in the wayside and in-car noise compared to operation on concrete aerial structure. This is due to the sound absorption provided by the porous ballast material. This means that, all other things being equal, the wayside noise levels from at-grade ballast and tie track facilities will be somewhat less when compared with noise levels at the same distance from aerial structure operation.

For maintenance reasons, typical sound barrier walls for at-grade track facilities are usually located farther away from the track structure compared to aerial applications. Consequently, the barrier wall for at-grade facilities must be slightly higher (nominally 5 feet above top-of-rail) for the same amount of wayside noise reduction.

The installation of sound-absorbing material on the inside face of at-grade sound barrier walls has not been found to be particularly effective when used along ballast and tie sections. The reason for this is due to the reduced effectiveness of adding more absorption in addition to that already provided by the ballast. It may be possible to combine a slightly higher wall with added absorption where additional noise reduction is needed. This has yet to be tried for a system in revenue service and only minimal further reduction in wayside noise is expected.

Crossovers

The presence of switches at crossover points between two tracks is a special noise problem in itself, if standard, passive "switch frogs" are used. The standard switch has a significant gap at the crossover point that the vehicle steel wheel must pass over. The impact caused by this gap results in substantially higher noise and vibration levels adjacent to switch locations. The presence of switches, unless specially constructed units are used, has a much greater potential for impact on the adjacent community.

Because of the substantially increased noise levels at crossovers, such facilities should, if at all possible, be located away from residential and other noise sensitive areas. Where this is not possible specially designed switch "frogs" may be used if wayside noise levels are to be acceptable. A discussion of this subject is given in more detail in the Technical Report on Noise and Vibration (see Appendix D).

5.11.3 STORAGE AND MAINTENANCE YARD

Storage and maintenance yard noise would result from a number of major sources, including transit cars rolling on the tracks, transit car auxiliary equipment, coupling and uncoupling of cars, train horns, maintenance work, workers shouting, telephone buzzers, and public address systems. The specific details of the proposed Antioch yard are not available yet, but some general observations can be made. The location of the yard is adjacent to State Route 4, so ambient noise levels are already relatively high in the surrounding area. This factor, combined with the large distance to the nearest residences, would indicate no significant impact. When details of the yard design are known an analysis of specific noise impacts should be performed and noise control features investigated.

5.11.4 BART AND LRT ANCILLARY FACILITIES

The final location of all ancillary facilities has not been determined. At this stage only general observations are possible. The noise from ancillary facilities is subject to APTA design criteria for maximum noise levels.

The APTA design criteria would ensure that the noise generated by ancillary facilities, regardless of their final location, should be compatible with the ambient noise of the surrounding area.

The criteria for noise from ancillary facilities are similar to those for wayside noise, except that equipment generating continuous noise levels shall be limited to 5 dBA lower levels. All substations will be located above ground and transformer hum and cooling fan noise are the two main sources of noise from substations. The design of each ancillary facility will incorporate, as necessary, noise reduction features including sound barrier walls or complete enclosures around noise sources, and sound attenuators on fans, blowers, and cooling towers.

5.11.5 TRAFFIC-RELATED NOISE

Based on projections of traffic for the roads and highways in the corridor area, the amount of traffic is projected to increase significantly between 1980 and the year 2000. In some areas the peak hour volumes will at least double compared with existing traffic. This will result in a noticeable increase in the noise exposure levels of approximately 3 dBA for those parts of the corridor community adjacent to major transportation routes (e.g., State Route 4).

With selection of an alternative, traffic analysis shows that there would be only minor differences between the various alternatives. The maximum difference in traffic volumes during the peak hour are less than 15 percent on Port Chicago Highway and less than 5 percent on State Route 4 west of Willow Pass Road. These differences will not significantly affect noise levels, since traffic volume would need to increase by 100 percent before an increase in noise levels would be noticeable.

The change in traffic patterns around proposed stations would primarily consist of an increase in local peak-hour traffic and an increase in feeder buses. The resulting total change in automobile traffic would not cause a significant change in the cumulative noise levels.

5.11.6 RELATIVE IMPACT OF ALTERNATIVES

Each of the various proposed alternatives has been analyzed for environmental noise impact. Only the rail alternatives have been analyzed for vibration impact and only where alignments are close to vibration sensitive buildings, such as houses and hospitals. The major results of the impact analysis for each of the alternatives is summarized in the following discussion.

Alternative 1 (No Build)

This alternative consists of the existing and programmed highway and transit system improvements. The significant changes over the existing conditions are closer peak period headways on the BART Concord line and the addition of one to two lanes to Interstate 680 in both directions between Martinez and the Alameda/Contra Costa County line. In addition, there are proposed minor changes in both BART Express Bus and Tri-Delta Transit bus operations. The reduction in peak period headways on the BART Concord line will result in a 2-dBA increase in peak hour Leq and less than a 3-dBA increase in Ldn for communities adjacent to the existing Concord BART line. Based on the UMTA criteria, this would indicate that noise impacts are generally not significant.

Widening of Port Chicago Highway to four lanes is anticipated by the City of Concord as necessary to accommodate increased future traffic levels. Traffic levels are expected to double by the year 2000 in the region resulting in an increase in noise levels adjacent to the highway and in the local community. Widening of the highway will also move traffic noise sources closer to homes in this area. The combined effect of these two factors would be an estimated 2- to 3-dBA increase in the ambient noise levels relative to existing conditions. Based on UMTA criteria, this would indicate an insignificant impact.

However, the projected ambient noise exposure level for the homes along Port Chicago Highway is 65 to 67 dBA Ldn in the year 2000, based on existing ambient levels and projected traffic volumes and widening of the highway. This noise level is significantly above the 60-dBA noise goal set by Concord as acceptable for single-family residences. It is possible that the City may want to construct a sound barrier wall along the highway in order to reduce noise levels.

Widening of Interstate 680 is part of the State Transportation Improvement Plan (STIP) and is considered to be the responsibility of Caltrans. Noise impacts due to widening and increased traffic would normally be analyzed as part of a STIP EIR analysis.

Alternative 2 (TSM)

This alternative calls for reducing headways and several routing modifications for all three bus lines serving the corridor. Exact details of specific modifications are not currently available at this time and a detailed analysis of noise impact is not possible.

Where possible, new bus routes should use heavily travelled routes to avoid significant increases in noise. This is planned for BART express feeder buses which are to be reoriented to highways. For reductions in headways (i.e., more frequent bus passbys) individual routes would need to be examined in more detail. In general, reducing headways by one-half will have a noticeable impact (increased noise) on more moderately travelled streets. Consequently, where possible, major headway changes should be made to routes where existing vehicle traffic is or will be heavy.

Alternative 3 (HOV to Antioch)

Alternative 3 would primarily involve providing exclusive or semi-exclusive lanes for buses and for private vehicles used for carpooling. The initial section of the route would be along city streets in Concord, which are already heavily travelled. Additional buses running through downtown Concord would have a minor impact in terms of additional noise exposure on the commercial and office building occupants in this area.

On State Route 242 and State Route 4, the presence of an existing large volume of heavy truck traffic means that the additional express buses would have an insignificant impact on the adjacent communities. The increase in heavy vehicle traffic at peak hour times with the addition of HOV is no more than 10 percent. The reduction of highway traffic due to carpooling and bus patronage is projected to be minor enough to cause no noticeable reduction in traffic noise.

Construction of the express lanes in the highway median is expected to have a noticeable but short-term impact on the adjacent community. Criteria for noise emission from construction equipment can be used to minimize this impact.

Alternative 3A (HOV to Pittsburg)

The same noise impacts as Alternative 3 would result except improvements only extend to Railroad Avenue in Pittsburg.

Alternative 4 (LRT to Antioch)

The slower speeds for the LRT, shorter trains, and somewhat longer headways at peak hours results in significantly lower levels of wayside noise exposure when compared with the BART alternatives. With sound barrier walls where appropriate, the maximum passby noise level criteria are satisfied at all locations. As shown by selected samples of predicted noise in Table 5.11-1, the noise from trains on aerial structures in Concord would raise the peak hour Leq by 2 dBA for the residential area within 200 feet of the alignment. Increases of less than 3 dBA are considered to cause noise impacts that are generally not significant.

The need for a sound barrier wall on the aerial structure does not begin until the first residential area is reached at about 1 mile from the existing Concord Station. For this part of the alignment a sound barrier would be needed on both sides of the aerial structure. The standard aerial structure sound barrier wall is sufficient to control noise so as to meet both the absolute and relative noise criteria.

For the at-grade section of the alignment along Port Chicago Highway it would be necessary to have a standard at-grade sound barrier wall, especially where the houses are located within 25 feet of the near track. The noise levels on the west side of the highway are low enough to be within the absolute and relative criteria without a wall on that side. Consequently, a wall is needed just on the out-bound side of the alignment for the at-grade section.

A minor noise impact for this alignment is due to the effect of relocating the median of Port Chicago Highway about 5 feet to the east of the existing median. Local plans also anticipate widening the highway to four lanes to accommodate the increase in local traffic as discussed under Alternative 1 (No Build). This would have a beneficial effect when compared to the existing location of the highway, but without a rail structure in this area the highway median could be located in the center of the corridor, which would move the traffic noise source farther away from the houses on the west side. The net result of relocating the highway is expected to be a 1- to 2-dBA increase in traffic noise on the west side of the highway and a corresponding decrease on the east side of the highway.

As indicated in the discussion for the No-Build Alternative, the City of Concord will probably need to deal with the increased noise levels along Port Chicago Highway in the near future. Their approach to solving the problem would have an effect on the noise impact from the at-grade section of LRT along this part of the alignment. If Concord constructs a sound barrier wall at the property line on both sides of the highway, the LRT noise levels should be acceptable, assuming that a wall at least 6 feet high is built.

Vibration impact along the Port Chicago Highway alignment is predicted to be significant in areas where an aerial structure support column is within 30 to 40 feet of a single family residence. This situation will arise with approximately five houses. Use of special resilient rail fasteners, by providing more vibration isolation for the track, should produce enough reduction in ground-borne vibration to be satisfactory. For the at-grade ballast and tie section, where houses are within 25 feet of the near track, it may be necessary to use a special "ballast mat" to reduce ground-borne vibration levels sufficiently.

For the rest of this alignment, except at the crossover just after the West Pittsburg Station and the aerial section near the Antioch Station, the existing ambient noise levels are high enough and the closest houses are far enough away so as not to require sound barrier walls along the State Route 4 median part of the alignment.

The crossover just after the West Pittsburg station will result in noise levels at a nearby elementary school that would significantly exceed the maximum passby criterion without a sound barrier wall. There are also several houses near the crossover that will probably require a sound barrier wall to control noise if the standard switch frogs are used. Use of special frogs would obviate the need for sound barrier walls at the crossover.

Immediately after the alignment crosses to the north side of State Route 4, near the Antioch station, there are a few commercial buildings and two residences that are close enough to the aerial structure to need a sound barrier wall on the inbound side of the alignment so as to satisfy the passby noise criteria at these buildings.

Alternative 4A (LRT to West Antioch)

Same impacts as Alternative 4 would result except LRT terminates at Somersville Road in West Antioch. The LRT maintenance yard operation in Pittsburg would not result in significant noise or vibration impacts.

Alternative 5 (LRT to Antioch via SPTC)

This alignment follows the same route as Alternative 4 until reaching the intersection of Willow Pass Road and State Route 4. It then follows Willow Pass Road (east) in West Pittsburg. The operational specifications for the LRT are also the same up to this point. Consequently, the same requirements for sound barrier walls that apply to Alternative 4 also apply to this alternative.

The Willow Pass Road part of the alignment is subjected to a relatively high existing noise environment due to truck traffic. As a result of the high ambient noise in this area, the residential community fronting the road would not be affected by LRT wayside noise, except for a group of single family houses currently being built near the proposed West Pittsburg Station.

A sound barrier wall has been constructed along the Willow Pass Road property line of the residential project so as to reduce the impact of traffic noise. The proposed aerial structure for this part of the alignment would raise the LRT above the wall, thereby eliminating any shielding the wall would otherwise provide for at-grade noise sources. A standard sound barrier wall is recommended for the westbound side of the structure.

For the rest of the alignment and independent of the possible SPTC buyout, the only places where sound barrier walls are recommended are at crossovers and where single family residences are less than 100 feet from the nearest track.

The vibration impact for the Port Chicago Highway portion of this alternative will be the same as for Alternative 4. Along the SPTC portion of the alignment, the closest houses are 50 feet; however, LRT speeds along that section are nearly double other sections of the alignment. The residences adjacent to the railroad track, as indicated in the discussion of the existing ambient vibration, are currently exposed to levels of vibration from freight traffic that should be perceptible. Consequently, ground-borne vibration criteria for transit operation are somewhat higher than in other areas of the alignment.

The combined effect of these factors should result in acceptable levels of LRT ground-borne vibration in adjacent residences, if standard ballast and tie track are used. However, at crossovers, the use of standard switch frogs will, as with noise, result in substantially higher levels of ground-borne vibration.

It may not be possible to reduce vibration levels adequately at crossover points with standard frogs, even with use of a special ballast mat as discussed under Alternative 4. Unless special switch frogs are used to reduce high levels of impact at switches, it may be necessary to use a floating slab form of isolation for these sections. If this is found to be the case during the engineering design of the alignment, it will probably be necessary to use a sound barrier wall with absorption or a floating slab design with ballast to produce acceptable levels of wayside noise.

A secondary impact of the SPTC alignment is the effect of moving the existing freight line tracks approximately 12 to 15 feet to the north of the existing track location. This will have the effect of slightly reducing freight train noise in the residential community to the south of the tracks and the opposite effect on the community on the other side.

Alternative 6 (BART to North Concord/Martinez)

Although a particularly short alignment (affecting only Concord), the operational plan for this alternative is for double the number of cars in each BART train, resulting in higher noise levels. The need for a sound barrier wall on the aerial structure begins within the first 0.25 miles of this alignment and continues until the profile comes down to grade near North 6th Street. The sound barrier wall will be needed on both sides of the way structure for this section of the alternative.

When the first residential area is encountered, at about 0.75 miles from the Concord BART Station, a wall alone may not produce acceptable wayside noise levels. The analysis indicates that sound absorption will also be required to control noise from operation on the aerial structure in this area.

Where the houses on the east side of Port Chicago Highway are within 25 feet of the near track on the aerial structure, even the addition of absorption will not be sufficient to adequately reduce noise levels to acceptable levels. Passby noise levels for 3 to 5 houses will be about 3 dBA above the passby criterion. Noise exposure levels would increase about 6 dBA above the existing peak hour Leq, which is considered to result in a generally significant impact.

Where the at-grade track is within 50 feet of houses, a standard sound barrier wall will not be sufficient to reduce noise to achieve APTA criteria. Maximum passby criteria will be exceeded by about 5 dBA at houses within 25 feet of the near track and noise exposure levels for peak hour Leq will be increased by 6 dBA above existing ambient. As discussed previously, addition of absorptive material will not be effective unless a higher wall is used. Even with a higher wall and absorption, it appears unlikely, based on the analysis results, that it will be possible to produce acceptable wayside noise levels for this part of the community to achieve APTA criteria.

If the City of Concord builds a high sound barrier wall at the property line on both sides of the highway the effect would be the same as a sound barrier wall near the BART tracks. It is possible that absorptive treatment and a higher wall at the property line would reduce the noise impact to an acceptable level with the BART operational plan proposed for this alternative.

The impact from ground-borne vibration on nearby residential dwellings is expected to be significant for this alternative, unless special vibration reduction measures are implemented. The vibration levels from BART operation will be significantly higher than for the LRT, due in part to greater vehicle speeds and longer trains. For areas where residences are within 50 feet of aerial structure support columns, it will be necessary to use special resilient fasteners for vibration isolation of the rails. It may also be necessary to isolate the guideway at individual columns in these areas. Where residences are within 25 feet of support columns, it may be necessary to isolate the guideway in addition to using special rail fasteners in order to produce acceptable levels of vibration.

In the depressed and cut-and-cover sections of the Port Chicago Highway alignment, special resilient fasteners may be needed to produce acceptable levels of vibration in nearby residences. For at-grade sections it may be necessary to resort to vibration isolation that is achievable only with a floating slab type track support. This would be needed to reduce ground-borne vibration levels in residences at 25 feet from the near track. A ballast mat in this area may not provide enough reduction. To avoid creating higher noise levels it may be necessary to use a sound barrier wall with absorption or a floating ballast "tub" type isolation. Use of a resiliently supported slab would increase wayside noise levels, particularly at low frequencies.

Even with use of special vibration isolation measures, vibration levels within 25 feet of standard switch frogs do not achieve criterion compliance. As previously discussed, it may be necessary to use special frogs at the crossover points in the Port Chicago section of the alignment or move the crossover to another location away from houses.

A secondary impact of this alternative is the effect of relocating Port Chicago Highway median from its current location. A discussion of this subject is given under Alternative 4. It may be possible that the City of Concord will want to construct a sound barrier wall independent of the plans for the corridor. In this case it may not be necessary to build a sound barrier wall for the at-grade section of this alignment.

Alternative 7 (BART to Antioch)

This alternative has the same alignment along Port Chicago Highway as do the other rail alternatives. The main difference between this alternative and Alternative 6 is a reduction by a factor of one-half the number of cars per train. This means that, in general, the wayside noise levels will be lower for this alternative when compared with Alternative 6. The wayside passby noise levels and noise exposure for the adjacent community in Concord will still be higher for this BART alternative when compared with the LRT alternatives in this area.

Except for a few isolated areas, the consideration for a sound barrier wall on the aerial structure does not start until after the first 0.5 mile of the alignment. For commercial buildings close to the aerial structure and a church within 200 feet of the alignment in the first 0.5 mile, it is possible that a sound barrier wall will not be necessary due to other mitigating factors such as shielding by intervening buildings.

The residential community to the east of the aerial structure will be exposed to passby levels that are in some cases as much as 5 dBA above the criterion unless absorption is added to the sound barrier wall. With sound absorption on the sound barrier the passby criterion will be satisfied and changes in existing noise exposure levels should be less than 3 dBA and generally no impact indicated.

For the at-grade section of the Port Chicago Highway, the noise impact of this alternative is less than that for Alternative 6, but, even with a standard sound barrier wall, the residences will be exposed to wayside noise that exceeds the criteria. An additional 3 to 5 dBA of noise reduction is needed to reduce the passby maximum and exposure noise levels to satisfy the criteria.

Alternative 7 also includes a 900-foot south yard lead in the existing BART maintenance facility south of the Concord BART station. The distance between the south yard bed and nearby homes (at least 200 feet) and the presence of existing BART train operations at the maintenance yard would preclude any substantial change in noise effects at the residence. Existing noise from the more frequent main line trains and the movement of trains on the yard (which is between the south yard lead and the nearest lane) would not be changed significantly by the small number of daily operations on the south yard lead.

As discussed under Alternative 6, a higher sound barrier wall, with possible absorption added to the inside face, may possibly produce the needed extra reduction. If the City of Concord were to build a sound barrier wall to control traffic noise along the eastern property line, as discussed under Alternative 1 (No Build), this would produce a similar effective noise reduction for BART train operations. Noise impacts of relocating the median of Port Chicago Highway are discussed under Alternative 4.

The houses in the vicinity of the crossover will be exposed to levels of noise that are too high to reduce by means of a sound barrier wall. Unless special switch frogs are used, there would remain a noise impact for the approximately 30 houses on both sides of Port Chicago Highway near the switches.

The impact from ground-borne vibration along the Port Chicago Highway section of the alignment is only slightly less than that for Alternative 6 due to shorter trains. Therefore, the same vibration reduction measures may be needed for this alternative.

The remainder of this alignment is in the median of State Route 4 similar to Alternative 4 (LRT). The wayside noise levels are somewhat higher for BART operation on this alignment when compared with LRT operation for reasons previously discussed. Sound barrier walls are recommended at crossover locations, where aerial structure is within 150 feet of single family residences, and near the proposed Antioch Station where several churches are located within 150 feet of the aerial structure and two houses within 75 feet. Standard sound barrier walls without absorption will sufficiently control wayside noise, resulting in essential compliance with maximum passby criteria and increases in peak hour Leq of 4 dBA, which means only possible impact is indicated.

The houses along the State Route 4 portion of the alignment are far enough away for ground-borne vibration levels to be sufficiently attenuated when standard ballast and

tie track is used. No special vibration isolation measures should be needed for the State Route 4 portion of the alignment, except where crossover points are located within 200 feet of residences and other vibration sensitive buildings.

Alternative 7A (BART to West Pittsburg)

This alternative has the same impact as Alternative 7 except BART terminates at Bailey Road in West Pittsburg.

Alternative 7B (BART to West Pittsburg)

The same impact as Alternative 7 results with this alternative except BART terminates at Railroad Avenue Pittsburg.

Alternative 8 (BART to North Concord/Martinez; LRT to West Antioch)

This alternative is a combination of BART up to the proposed North Concord/ Martinez Station and LRT thereafter to West Antioch via the median of State Route 4. The operational parameters are those of Alternative 7 for BART and Alternative 4 for LRT. The requirements for sound barrier walls and resulting noise impact on the adjacent community are discussed under the respective alternatives. The requirements for vibration reduction for the Port Chicago Highway section are discussed under Alternatives 6 and 7. The LRT maintenance yard operation in Pittsburg would not result in significant noise or vibration impacts.

5.11.7 MITIGATION MEASURES

Mitigation of transit operation noise and vibration is approached by establishing performance standards, design criteria, and vehicle specifications. The major tool utilized to accomplish this will be the contract documents developed by BART and designers and construction contractors.

Aerial Operations

The aerial system has special design features where needed which include, but are not limited to, the following:

1. All-concrete aerial guideways and column supports.

2. Sound barrier walls with sufficient height (nominally 3.5 to 4 feet above top-of-rail) to "shadow" the noise transmitted from the train to the wayside. The design and construction of such walls should include sufficient thickness and mass and be adequately sealed at all joints. Such barriers could be constructed in a variety of forms such as:

   - Nonabsorptive barriers where only standard wall is needed.

   - Absorptive barriers treated with special acoustical absorbing material on the interior face of wall, where additional noise reduction is needed.

Location and extent of sound barrier walls are dependent on the particular alternative. The shortest length of sound barrier wall is required for Alternative 4. In descending order of amount of sound barrier wall required are: Alternatives 7, 5, 8, and 6.

3. Special, resilient rail fasteners, which are "softer" than standard.

Location and extent of special rail fasteners are also dependent on the alternative. The order in terms of descending need when comparing alternatives is the same as that for sound barrier wall requirements, as above.

At-Grade Operations

The at-grade ballast and tie system has special mitigation measures where needed which include, but are not limited to, the following:

1. Sound barrier walls with sufficient height (nominally 5 feet from top-of-rail) to "shadow" the noise transmitted from the train to the wayside. The design and construction of such walls should be similar to those for aerial way structure.

2. Resiliently supported ("floated") ballast tub for ground-borne vibration reduction on Alternatives 6, 7, 7A, 7B, and 8.

3. Special ballast mat for ground-borne vibration reduction on Alternatives 4, 4A, and 5.

Depressed and Cut-and-Cover Operations

The depressed and cut-and-cover system has special mitigation measures where needed which include, but are not limited to, the following:

1. Special, resilient rail fasteners on Alternatives 6, 7, 7A, 7B, and 8 for vibration reduction.

Ancillary Facilities

These facilities, including power substations and emergency power generation equipment, will be modified to minimize noise and vibration using the following specific mitigation measures where needed:

1. Total enclosure of certain noise sources.
2. Sound barrier walls surrounding the source.
3. Sound attenuators on fans and ducts.
4. Special mufflers.

5.12 AIR QUALITY

5.12.1 REGIONAL ANALYSIS

The regional air quality impacts of the project will result from changes in regional automobile emissions. Changes in the regional Vehicle Miles Travelled (VMT) corresponding to each project alternative were used to estimate the net change in the regional air pollution burden. Since ozone (O_3) is the regional air pollutant of concern in the San Francisco Bay Area, the analysis we focuses on emissions of O_3 precursors, namely, nitrogen oxides (NO_x) and reactive hydrocarbons (RHC). The results of our calculations are presented in Table 5.12-1. All changes are with respect to Alternative 1, the No-Build Alternative.

Because Alternatives 2 through 8 provide increased public transport through HOV, BART, or LRT, the total VMT for these alternatives is less than for Alternative 1. Consequently, emissions of NO_x and RHC in Contra Costa County are less for Alternatives 2 through 8 than for Alternative 1. The analysis of the effect of changes in NO_x and RHC emissions on O_3 levels would require a comprehensive air pollution model for O_3 such as the urban airshed model. (RHC emission reductions generally lead to a reduction in O_3 concentrations but NO_x emission reductions may lead to an increase or a reduction in O_3 concentrations.) However, since both RHC and NO_x emissions levels would be reduced in comparable amounts by the project, it is likely that O_3 levels would decrease. In addition, the reduction in NO_x emissions would lead to a reduction in NO_2 concentrations.

5.12.2 LOCAL ANALYSIS

Local air pollution problems pertain primarily to CO concentrations. A review of the traffic projections corresponding to the various alternatives showed traffic along State Route 4 would decrease for the alternatives involving BART, LRT, or HOV compared to the No-Build Alternative. Therefore, CO ambient concentration should decrease along State Route 4 for Alternatives 2 through 7 (compared to Alternative 1). Traffic may increase, however, in the vicinity of BART or LRT stations. Consequently, CO air quality near these stations are addressed in detail.

Air quality impacts were predicted for the year 2000 at three proposed BART stations in the Pittsburg-Antioch Corridor area. These were the Bailey Road Station, the Railroad Avenue Station, and the Hillcrest Avenue Station.

To evaluate these impacts, the California Line Source Dispersion Model, CALINE4, was used. CALINE4 is the latest in a series of line source air quality models developed by Caltrans. It is based on the Gaussian diffusion equation and employs a mixing zone concept to characterize pollutant dispersion over the roadway. The model uses traffic emissions, site geometry, and meteorology to predict air pollutant concentrations near roadways. Predictions can be made for CO, nitrogen dioxide NO_2, and suspended particles. Options for modeling near intersections, parking lots, elevated or depressed freeways, and within city canyons are provided. Emissions from vehicles in the study area were estimated with the EMFAC7PC program. CALINE4 and EMFAC7PC were supplied by the California Air Resources Board. The modeling assumptions are described in detail in Appendix E. A wind speed of 1 meter per second ambient air temperature of 40°F, and a neutral atmospheric stability were assumed. These assumptions provide worst-case conditions.

TABLE 5.12-1

REGIONAL VMT AND CHANGES IN RHC AND NO_X REGIONAL EMISSIONS

Alternative	Net Change in VMT		Net Change in Pollutant Emission (lb)			
			RHC		NO_x	
	Daily	Annual	Daily	Annual	Daily	Annual
1 (baseline)	0	0	0	0	0	0
2	-46,000	-15,594,000	-335.8	-113,836.2	-276.0	-93,564.0
3	-64,000	-21,696,000	-467.2	-158,380.8	-384.0	-130,176.0
3A	-74,000	-25,086,000	-540.2	-183,127.8	-444.0	-150,516.0
4	-87,000	-29,493,000	-635.1	-215,298.9	-522.0	-176,958.0
4A	-87,000	-29,493,000	-635.1	-215,298.9	-522.0	-176,958.0
5	-95,000	-32,205,000	-693.5	-235,096.5	-570.0	-193,230.0
6	-87,000	29,493.00	-635.1	-215,298.9	-522.0	-176,958.0
7	-142,000	-48,138,000	-1,036.6	-351,407.4	-852.0	-288,828.0
7A	-124,000	-42,036,000	-905.2	-306,862.8	-744.0	-252,216.0
7B	-134,000	-45,426,000	-978.2	-333,609.8	-804.0	-272,556.0
8	-104,000	-35,256,000	-759.2	-257,368.8	-624.0	-211,536.0

Source: Bechtel Civil, Inc. 1988.

The predicted air quality impacts from CALINE4 at the Bailey Road Station, the Railroad Avenue Station, and the Hillcrest Avenue Station are presented in Tables 5.12-2 and 5.12-3. These results do not include ambient background concentrations. Note that the 8-hour values were estimated from the hourly concentrations by use of a conversion factor of 0.7.

TABLE 5.12-2
MAXIMUM HOURLY CONCENTRATIONS OF CO IN PPM BY ALTERNATIVE
(YEAR 2000)

Alternative	Bailey Avenue Station	Railroad Avenue Station	Hillcrest Avenue Station
1	1.5	1.9	0.7
2	1.4	1.9	0.7
3	1.5	1.9	0.7
4	1.5	1.9	0.7
5	1.5	1.9	0.7
6	1.5	1.9	0.7
7	1.5	1.9	0.7

TABLE 5.12-3
MAXIMUM 8-HOUR CONCENTRATIONS OF CO IN PPM BY ALTERNATIVE
(YEAR 2000)

Alternative	Bailey Avenue Station	Railroad Avenue Station	Hillcrest Avenue Station
1	1.1	1.3	0.5
2	1.0	1.3	0.5
3	1.1	1.3	0.5
4	1.1	1.3	0.5
5	1.1	1.3	0.5
6	1.1	1.3	0.5
7	1.1	1.3	0.5

These data show that at each of the stations there is little or no change in the predicted air quality impact due to different traffic flow volumes produced by each alternate.

5.12.3 MITIGATION MEASURES

No significant adverse impacts on air quality would result from the implementation of the alternatives; therefore, no mitigation measures are necessary.

5.13 ENERGY ANALYSIS

An analysis of Alternatives 2 through 8 shows that these alternatives will require less energy than Alternative 1, the No-Build Alternative. The savings are a result of modified travel patterns which generate less automobile mileage and increased use of more energy-efficient forms of transportation.

The energy analysis includes the change in energy consumption and potential savings associated with automobile, bus, LRT, and BART travel relative to the No-Build Alternative, and compares these totals with construction energy requirements for each alternative.

Exhibit 5.13-1 shows the number of years required for each alternative's energy savings to break even with the energy required for construction of that alternative.

Alternative 2 (TSM) has the shortest payback/break even period (less than 1 year) and Alternative 4 has the longest period (almost 10 years). The payback period is calculated by dividing construction energy estimates by transportation energy savings over the No-Build Alternative.

Estimates of transportation energy use and savings and construction energy are shown in Table 5.13-1. Several categories are included: incremental changes in automobile, bus, LRT, and BART usage; station power; and construction energy requirements. The energy consumption for each alternative is based on a comparison with the No-Build Alternative. In addition, payback rates are included for each alternative.

All alternatives would reduce automobile usage and therefore gasoline consumption. BART Alternatives 7, 7A, and 7B result in the greatest reductions. Bus usage is approximately the same for all alternatives with HOV Alternatives 3 and 3A showing slightly more than the rest. The trend in total project energy savings parallels the savings in gasoline consumption as shown on Exhibit 5.13-2.

The payback figures shown in Exhibit 5.13-1 and Table 5.13-1 indicate that the construction energy cost of Alternative 2 would be equalled by the potential energy savings in approximately 6 months. The other alternatives would require from about 3 years to almost 10 years.

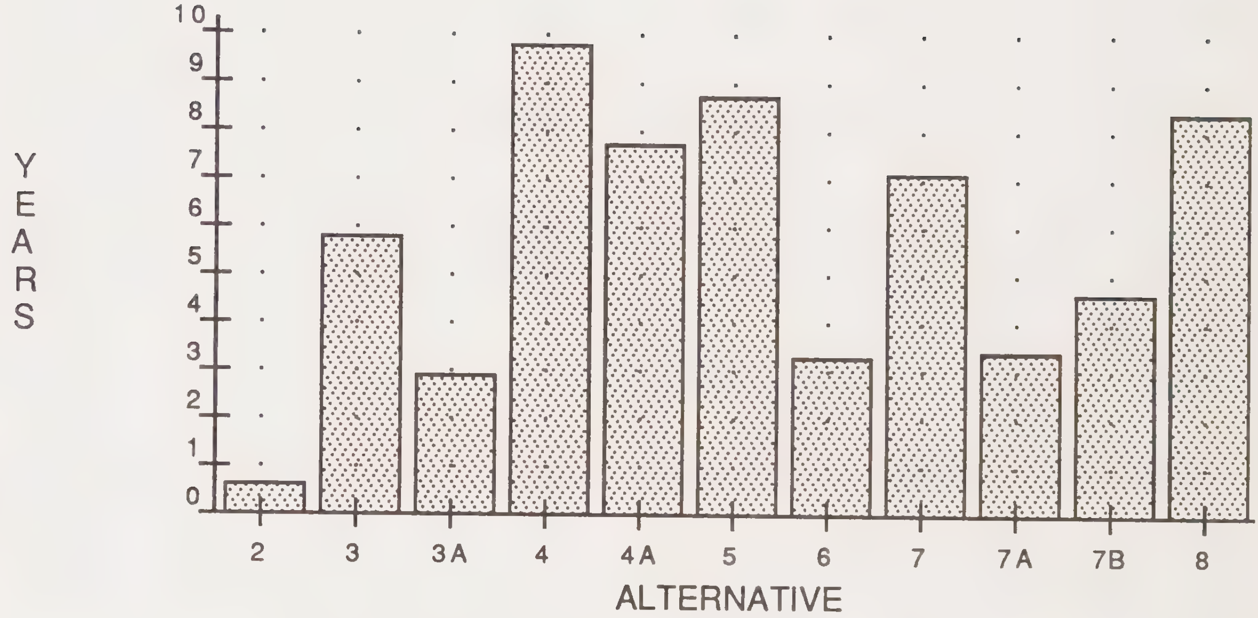
TABLE 5.13-1

ENERGY SAVINGS BY ALTERNATIVE

Transportation Mode	Alternative 2	3	3A	4	4A	5	6	7	7A	7B	8
Automobile											
1 Annual Mileage Change	-1.56E+07	-2.17E+07	-2.51E+07	-2.95E+07	-2.95E+07	-3.22E+07	-2.95E+07	-4.81E+07	-4.20E+07	-4.54E+07	-3.53E+07
2 Annual Change in Fuel Consumption (gal)	-7.80E+05	-1.08E+06	-1.25E+06	-1.47E+06	-1.47E+06	1.61E+06	-1.47E+06	-2.41E+06	-2.10E+06	-2.27E+06	-1.76E+06
3 Annual BTU Change	-9.75E+1-	-1.36E+11	-1.57E+11	-1.84E+11	-1.84E+11	-2.01E+11	-1.84E+11	-3.01E+11	-2.63E+11	-2.84E+11	-2.20E+11
Buses											
4 Annual Mi'eag, Change	1.60E+06	2.00E+06	1.90E+06	1.40E+06	1.50E+06	1.40E+06	1.30E+06	1.40E+06	1.40E+06	1.40E+06	1.30E+06
5 Annual Change in Fuel Consumption (gal)	3.56E+05	4.44E+05	4.22E+05	3.11E+05	3.33E+05	3.11E+05	2.89E+05	3.11E+05	3.11E+05	3.11E+05	2.89E+05
6 Annual BTU Change	4.94E+10	6.18E+10	5.87E+10	4.32E+10	4.63E+10	4.32E+10	4.02E+10	4.32E+10	4.32E+10	4.32E+10	4.02E+10
BART											
7 Annual Change in Car-Mile	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.00E+05	2.00E+06	4.00E+05	9.00E+05	9.00E+05
8 Annual BTU Change	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.80E+10	4.00E+10	8.00E+09	1.80E+10	1.80E+10
9 Number of New Stations	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.00E+00	5.00E+00	5.00E+00	5.00E+00	5.00E+00
10 Annual BTU Consumption	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0 nnE+00	0.00E+00	3.81E+09	1.90E+10	1.90E+10	1.90E+10	1.90E+10
LRT											
11 Annual Car-Miles	0.00E+00	0.00E+00	0.00E+00	1.00E+06	8.00E+05	1.00E+06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.00E+05
12 Annual BTU Consumption	0.00E+00	0.00E+00	0.00E+00	1.88E+10	1.50E+10	1.88E+10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.13E+10
13 Number of New Stations	0.00E+00	0.00E+00	0.00E+00	7.00E+00	7.00E+00	8.00E+08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.00E+00
·14 Annual BTU Consumption	0.00E+00	0.00E+00	0.00E+00	1.78E+10	1.78E+10	2.03E+10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.62E+09
Total Operating Energy	-4.80E+10	-7.38E+10	-9.81E+10	-1.05E+11	-1.05E+11	-1.19E+11	-1.22E+11	-1.99E+11	-1.92E+11	-2.04E+11	-1.24E+11
Total Construction Cost	1.20E+07	1.72E+08	1.14E+08	4.08E+08	3.24E+08	4.16E+08	1.59E+08	5.63E+08	2.61E+08	3.73E+08	4.16E+08
Construction Energy	3.00E+10	4.30E+11	2.85E+11	1.02E+12	8.10E+11	1.04E+12	3.98E+11	1.41E+12	6.53E+11	9.33E+11	1.04E+12
Payback - Years	0.62	5.82	2.91	9.76	7.70	8.74	3.25	7.09	3.39	4.58	8.37

Source: Bechtel Civil, Inc. 1988.

JBX/4580001E1x

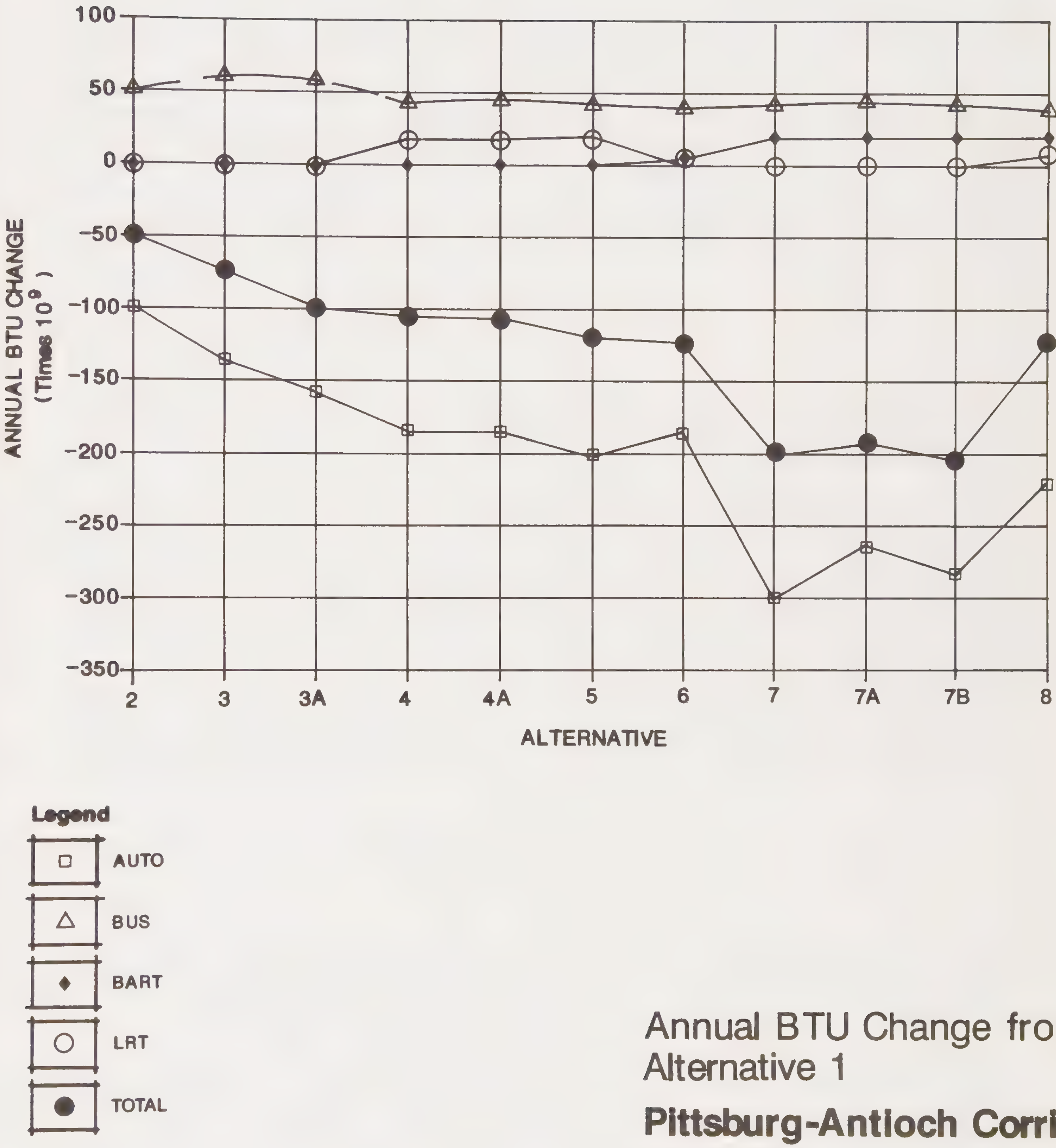


Pay Back Period
For Each Alternative
Pittsburg-Antioch Corridor
AA/DEIR

NO SCALE

BART

Exhibit 5.13-1



Annual BTU Change from Alternative 1

Pittsburg-Antioch Corridor AA/DEIR

BART

Exhibit 5.13-2

5.14 CONSTRUCTION IMPACTS

The construction of any of the alternatives expect Alternative 1 (No Build) and Alternative 2 (TSM) would require a major construction effort. The construct effort and duration would increase with the longer alignment alternatives. The number and locations of stations also effects the degree construction impacts. The HOV Alternatives 3 and 3A would require construction of additional freeway lanes. Construction equipment would include pickups, dozers, loaders, motor graders, scrapers, water trucks, compactors, dump trucks, concrete pavers, concrete trucks, rollers, and a variety of other service vehicles. The LRT and BART Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would require similar equipment to that previously mentioned along with boom trucks, cranes, pile drives, ballast compactors, ballast trains and other equipment essential for LRT and/or BART rail construction at-grade or aerial.

5.14.1 ECOSYSTEMS

Construction along any of the proposed alternative alignments will result in the disturbance of some natural communities within the direct construction area. Equipment operation and other activities may result in disturbing wildlife in adjacent habitats. Sedimentation may result from construction-initiated erosion. Sediments entering drainage systems may result in the loss or degradation of wetland habitat particularly with Alternative 5 (LRT to Antioch via SPTC). Direct disturbance from equipment operation related to construction is expected to be confined to narrow corridors along the proposed routes. Natural habitats in the immediate vicinity of the potential construction sites are generally of low quality and do not support valuable wildlife communities. Therefore, indirect impacts on wildlife are expected to be minor. Erosion and ensuing sedimentation can be controlled by sound construction practices and should not result in substantial offsite disturbance of wetland habitats. Any construction impacts that do occur will be of short duration and limited to the immediate vicinity of the construction site. Therefore, these potential construction impacts will not be significant.

5.14.2 HYDROLOGY AND WATER QUALITY

Surface Water

Construction activities, particularly cut-and-cover and tunneling, will cause disruption of soil, loss of ground cover, and involve a significant amount of earth moving. Depending on the alternative selected, as many as 20 streams could be crossed by the project. Soil excavation and earthmoving can have a temporary impact on the surface water quality due to increased sedimentation and infringement into the waterway. Increased sedimentation often results in poorer water quality as dissolved oxygen decreases, organic nutrients increase, suspended solids increase, as well as bacterial loading. Construction in the streams and waterways will also increase sedimentation, alter streamflow and has the potential to alter the water course.

Institution of sediment and erosion control measures such as shoring, revegetating, dust control, sandbagging, and care in the transport and disposal of earth will minimize the construction phase impacts.

Groundwater

In areas where significant underground construction is necessary and the excavation is below static groundwater levels, pumpage would be required and thus increase the potential for groundwater contamination. However, instruction and sediment control measures will minimize impacts on groundwater quality during construction.

Floodplains

As identified in Section 5.10, there are a few places along the rail alternatives that lie in areas designated as a 100-year floodplain. Most of these areas are around streams or confluences of streams and waterways. Construction activity through these areas could result in more soil disturbance and hence the potential for water quality degradation during flooding at the location increases. However, these areas are very small in size and construction will be scheduled during times when rainfall is not likely to occur so as to minimize any impacts that could occur.

5.14.3 CONSTRUCTION NOISE AND VIBRATION

One of the impacts associated with a rail rapid transit system project is the short-term effects of noise and vibration from construction activities. As with any large project, the construction of major transportation facilities involves the use of machines and procedures which, in the past, have resulted in intense noise levels and occasionally, high vibration levels in and around the construction site.

The control of noise and vibration during the construction of either rail transit alignment or during road construction is important to minimize adverse impacts on the neighboring community. This is particularly true because sections of the proposed rail alignments are located very close to a number of existing residential buildings, especially in Concord.

There are numerous procedures available for reducing the noise generated by construction equipment activities. One of the most effective methods of assuring controlled noise and minimum acoustic impact is the inclusion of noise limit specifications in the construction contract documents. Recent construction projects of BART, New York City Transit Authority, (NYCTA), WMATA, and MARTA systems have included noise restrictions in the contract specifications.

Criteria for construction noise and vibration control in a format appropriate for inclusion in construction contracts documents should be developed in the engineering phase. The specification should require the construction contractor to comply with state and local ordinances, regulations, and other sections of the criteria document. Application of noise and vibration control specification similar to that provided will minimize intrusion during the construction phases of the project.

5.14.4 AIR QUALITY

Construction activities, while temporary, have the potential to degrade local air quality. These impacts are characterized by locally increased levels of gaseous pollutants due to operation of heavy duty construction equipment and by locally increased levels of dust (fugitive emissions) due to earth clearing/moving operations.

Methodology

To evaluate the relative differences between each alternative, the following methodology was used:

- Develop estimates of the type and number of equipment required for each phase of construction.

- Develop the specific phases required for each alternative.

- Develop the quality of emissions each phase could produce.

- Evaluate the total emissions produced by each alternative in relationship to the other alternatives.

One of the project phases includes impacts from railroad locomotives. To adequately estimate emissions from these sources, detailed values of fuel consumption, train frequency, and source type is required. These data were unavailable. Additionally, emission information on train type sources is limited. Consequently, the impacts from train-based sources were not included in this analysis.

Emissions were estimated from the EPA's AP-42 document, assuming published emission factors for the 1987+ time period. The emission factors are separated on the basis of fuel type (diesel/gas). It was assumed that all heavy duty equipment used diesel fuel. Light duty trucks and service vehicles were assumed to burn gas. AP-42 provides estimates for heavy duty construction equipment in terms of pounds per hour while emission rates for gasoline sources are given in grams per mile. To make the emission rates compatible between source types, the gasoline sources were assumed to travel 50 miles in an 8-hour period.

Based on the predicted potential source types, emission factors for CO, SO_2, NO_x, RHC, and PM-10 were developed. AP-42 makes no distinction between total suspended particulates (TSP) and PM-10. Thus, all emitted particulates were assumed to be PM-10. Table 5.14-1 shows the actual AP-42 based emission factors used.

TABLE 5.14-1

GENERAL EMISSION FACTORS
Time Period: 1987+

Equipment	CO (lb/hr)	Pollutant SO_2 (lb/hr)	NOx (lb/hr)	RHC (lb/hr)	PM-10 (lb/hr)
Pickups, Service Veh.	0.141	0	0.0146	0.0112	0
Dozers	1.794	0.348	4.166	0.065	0.165
Loaders	0.572	0.182	1.89	0.041	0.172
Motor Graders	0.151	0.086	0.713	0.012	0.061
Scrapers	0.257	0.463	3.84	0.143	0.406
Trucks	1.794	0.454	4.166	0.112	0.256
Rollers	0.304	0.067	0.862	0.016	0.050
Other Const. Equipment	0.675	0.143	1.691	0.031	0.139

Source: EPA 1985.

Emission Estimate

The estimate of emissions produced from each alternative was based on conceptual project information. For each source, the type of source and the duration of use was calculated. This information was then applied to the AP-42 emission factors and the total amount of pollutants due to the source were then estimated. The impact from each alternative was then determined by the total sum of all sources for the duration of each alternative. The total impact expressed in tons of pollutants is shown in Table 5.14-2. It should be noted that due to the conceptual nature of the data used, these estimated emissions should be seen in terms of relative potential impacts of each alternative and not in terms of absolute maximum impacts.

TABLE 5.14-2
TOTAL ESTIMATED EMISSIONS BY ALTERNATIVE

Alternative	CO(Tons)	Pollutant SO_2(Tons)	NOx(Tons)	RHC(Tons)	PM-10(Tons)
3	38.7	9.3	89.2	2.4	5.5
3A	24.7	5.9	56.7	1.5	3.5
4	68.1	15.4	157.1	3.8	10.6
4A	49.3	11.2	113.9	2.8	7.7
5	142.4	31.6	325.7	7.9	22.1
6	42.3	9.5	97.6	2.4	6.6
7	85.7	19.4	198.3	4.8	13.4
7A	44.3	10.0	102.2	2.5	6.9
7B	73.5	16.5	169.0	4.1	11.5
8	85.5	19.3	197.8	4.8	13.4

The emissions due to construction activities are not significant compared to the countywide emissions of these pollutants which, on an annual basis, amount to 152,000 tons of CO, 46,000 tons of RHC, 58,000 tons of NO_x, 27,000 tons of SO_2, and 30,000 tons of particulate matter (BAAQMD 1985).

Fugitive dust emissions will result from construction operations. Such emissions are typically proportional to the area undergoing construction. For the analysis, it was assumed that parking lot construction would, at a given time, represent the largest construction area. Emissions of fugitive dust from parking lot construction will amount to 1.2 tons per acre per month of activity based on AP-42. A typical parking lot area is estimated to be 17 acres. Therefore, fugitive dust emissions will amount to 20 tons per month of activity. This amount is not significant compared to the countywide monthly emissions of particulate matter which amounts to 2,500 tons (BAAQMD 1985).

5.15 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

Although the alternatives would result in adverse impacts to the physical environmental components, none of these impacts, except for visual aesthetics and construction and operational noise effects, are expected to be significant after the application of recommended mitigations. LRT and BART Alternatives 4, 4A, 5, 6, 7, 7A, 7B, and 8 would all result in significant unavoidable adverse impacts along Port Chicago Highway. Alternative 5 would also have significant visual impacts along Willow Pass Road in West Pittsburg. BART Alternatives 6, 7, 7A, 7B and 8 would result in significant unavoidable noise impacts on residences at the aerial and at-grade sections of the portion of the alignment along Port Chicago Highway. Residences within 25 feet of the aerial sections and residences within 50 feet of the at-grade sections would experience a significant noise impact that could not be mitigated to meet American Public Transit Association (APTA) noise guidelines. No other adverse impacts are expected to be significant after the implementation of the mitigation measures recommended in this report.

5.16 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The Pittsburg-Antioch Corridor is a major travel corridor that has experienced substantial growth in recent years. Due to this growth, future transportation demands in the corridor cannot be satisfied by highway improvements alone, thereby resulting in a need for highway and transit improvements.

A major advantage of the project to near-term development is the reduction of the existing traffic congestion along the Pittsburg-Antioch Corridor. The implementation of the project would increase the long-term productivity of the corridor in terms of providing greater access between employment centers and residential areas.

5.17 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The environmental changes produced by the implementation of the project would occur mainly as a result of alterations to the physical environment by highway and transit improvements. Implementation of the proposed highway and transit improvements would result in a short-term irreversible commitment of land. While it may be feasible to redevelop the transit alternatives in the long-term, it is probable that once a transit system is operating, the corridor would retain its transportation function for the foreseeable future.

The proposed project also represents an irretrievable commitment of energy resources. Construction and operational activities would result in the direct consumption of petroleum fuels and electricity. The project would reduce the net fuel consumption along the Pittsburg-Antioch Corridor by diverting highly fuel consumptive automobile trips to transit trips.

Furthermore, the proposed project would represent an irretrievable commitment of manpower, construction materials, and funding. The manpower expended to design, construct, and operate the transit system cannot be recovered. Also, the construction materials such as asphalt, cement, steel, lumber, and fabricated materials represent a commitment of resources that could not be retrieved. The financial resources committed to the construction and operation of a transit system for the Pittsburg-Antioch Corridor cannot be completely recovered. However, local and regional economic benefits would result from the consumption of these resources.

5.18 CUMULATIVE IMPACTS

The focus of the AA/EIR is to evaluate potential transportation alternatives designed to meet the corridor's existing and future transportation demands. Each alternative is evaluated using the year 2000 as a baseline. Therefore, the environmental impacts of each issue area are described in terms of implementation in the year 2000. This includes population projections by ABAG for the year 2000 and projected land uses as designated in general plans. As such, cumulative impacts are addressed in each issue area to the extent possible based on available projections of year 2000 conditions and cumulative growth in the corridor.

5.19 GROWTH-INDUCING IMPACTS

CEQA requires that an EIR discuss the growth-inducing impacts of a proposed project (Section 15125[g]). Specifically, CEQA requires a discussion of the ways in which a proposed project could foster economic or population growth or remove obstacles to growth. The CEQA guidelines further state that it must not be assumed that growth in any area is necessarily beneficial, detrimental, or of little significance to the environment.

As accessibility is improved, the advantages of living and doing business in the Pittsburg-Antioch Corridor increases. Since proximity to the transportation system is an advantage for system users, more concentrated growth often occurs around station areas. This growth is possible only if local governments increase allowable densities in the immediate vicinity and/or higher density development is economically feasible, since land values and rents rise.

Furthermore, improved accessibility can either lead to more regional growth or to a redistribution of growth. More regional growth occurs if the amount of development increases adjacent to station areas, but does not decrease elsewhere in the region. Redistribution of growth occurs if development increases near station areas, but decreases elsewhere in the region, due to public policy or economic constraints. The more perceptible impacts result from a redistribution of growth within the region, and not from absolute growth of the region.

Forecasts of population growth provided by ABAG are predicated on several assumptions, one of which assumes that sufficient transportation infrastructure will be in place to handle projected growth. Consequently, ABAG's projections do not represent a baseline forecast of population growth in the absence of transit improvements.

In general, unless the quality of life would dramatically worsen in an urban area (to which inadequate transportation facilities could contribute), a decline (or improvement) in infrastructure alone is insufficient to lead to major population changes. Other factors, such as availability of employment and housing, are more critical. It is unlikely, therefore, that an improvement in the transportation system--be it a rail or nonrail alternative--will lead to a change in projected corridor area or regional population growth. The more likely effect would be to increase development around station areas, which could increase population at station area locations, if the development included a residential component. However, again, it is likely that this would be a shifting of population growth within the region, rather than an absolute gain.

The corridor area has experienced expansion in employment in the past 20 years and is projected to continue employment expansion, but probably at a rate that is less than the rate of household growth in the east county cities of Pittsburg, Antioch, and Brentwood. One of the problems faced by this region is the geographic imbalance between employment and residential growth. Job growth is occurring in central Contra Costa County and in other San Francisco Bay Area counties, whereas the housing supply is expanding in the east county cities without commensurate job growth. In fact, if one examines the ratio of locally available jobs to employed residents, the ratios in the east county cities are projected to be mostly below 0.45 by the year 2000, except for the City of Pittsburg which is projected to be approximately 0.60. (A ratio of 1.00 would indicate that there was a job available for every employed resident.) In contrast, in other regions of the San Francisco Bay Area, for example Santa Clara County, the ratio is greater than 1.00. (Contra Costa County CDD 1987).

This imbalance results in long commutes and overcrowded streets and highways, particularly along the State Route 4 corridor. If the transportation system could be improved in the Pittsburg-Antioch Corridor, then job opportunities would be more accessible to the labor force. Rail alternatives would improve commuting conditions to a greater degree than the nonrail alternatives, since the rail alternatives include most of the nonrail improvements, as well as the benefits of rapid transit opportunities. (The one exception is BART to North Concord/Martinez, which would not provide direct rail access to regional employment opportunities for the labor force living in the east Contra Costa County area.)

If a rail alternative were selected, workers would be less auto-bound. Furthermore, it is possible that a rail alternative would lead to more intense land uses around stations. If these were employment-generating land uses, then workers could find transit-accessible employment opportunities expanded. Although it is likely that regional employment levels would not rise, it is likely that:

- Workers could experience an improved quality of life through shorter or more problem-free commutes; and

- Employment could be more concentrated around LRT or BART stations.

At present there are no major constraints on development within the corridor area, with the exception of congestion along State Route 4. Some cities need to expand services or infrastructure to accommodate additional growth. These needs will not constrain growth, since in all cases, expansions are planned. For example, the City of Antioch needs to expand its water plant, the City of Pittsburg needs to expand school capacity, and West Pittsburg needs additional water storage capacity. The one exception is the City of Brentwood, where inadequate sewer and water services have recently served to constrain development. Development fees vary by jurisdiction, but for the most part, are fairly typical of fees assessed by California cities. These include fees for road improvements, park dedication, and schools.

Transit impacts on real estate development are the most significant along the alignment itself. Transit may affect the nature and timing of new development on vacant land or redevelopment of areas already developed. Given the abundance of vacant land along the alignment, it is more likely that development impacts would be greater on future new development than on redevelopment.

The presence of a transit system, in itself, would not result in more intensive development along the alignment until there is adequate market demand. If that market demand is to be realized in intensive alignment development, then local zoning policies need to be supportive. At present, much of the vacant land is designated for industrial development which is not intensive.

In most cases, the presence of a station would not dramatically affect station area real estate trends. It will take up to 10 years to plan and implement a transportation system. During this time period, current planned development and redevelopment activities will be completed, and much of the vacant land in this corridor will also be developed regardless of which transportation alternative is selected. Although identification of station area sites could influence real estate development in advance of system construction since land owners could anticipate transit benefits,

the actual benefits from an operational transit system will occur too late to have a major impact on development. The one exception would be if local governments intervened and required higher density uses around station areas. This could result in land-banking of these sites until the market could support higher density uses.

The previous discussion provides an overview of growth-inducing impacts from selection of a transportation alternative. A more detailed discussion is provided in Appendix B.

SECTION 6

COMMUNITY INVOLVEMENT

Residents, city and county representatives and community and civic leaders throughout the Pittsburg-Antioch Corridor participated in identifying transportation alternatives and their associated environmental, social, and financial impacts. Participants included residents and representatives from the cities of Concord, Pittsburg, Antioch, Martinez, and Brentwood and the unincorporated community of West Pittsburg as well as representatives from Contra Costa County.

6.1 SUMMARY OF THE COMMUNITY INVOLVEMENT PROCESS

The community involvement process for the project began with the formation of the Board of Control and the Technical Advisory Committee in the fall of 1986. The Board of Control is a policy body chaired by the Bay Area Rapid Transit District Director and includes mayors and councilmembers from the cities of Martinez, Concord, Pittsburg, Antioch and Brentwood, a Contra Costa County Supervisor and representatives from Tri-Delta Transit, Caltrans and the Metropolitan Transportation Commission. The Board of Control meets approximately every other month with their primary focus related to the project's policy direction. The Board of Control reviews and approves most study deliverables.

A separate technical review body, the Technical Advisory Committee consists of planning, engineering and public works staff from the corridor cities of Concord, Martinez, Pittsburg, Antioch and Brentwood as well as representatives from the Bay Area Rapid Transit District, Contra Costa County, Tri-Delta Transit, Caltrans, Metropolitan Transportation Commission, Concord Naval Weapons Station, Federal Highway Administration and Atchison, Topeka, and Santa Fe, Southern Pacific Transportation Company and Union Pacific railroad companies. The Technical Advisory Committee meets every month with the primary purpose of providing technical review and approval of study deliverables.

A scoping meeting for the project was held in the City of Pittsburg on January 28, 1987. Approximately 250 notices of preparation including the announcement of the scoping meeting were mailed to local, state, and federal agencies and the general public. In addition, notice was given to the local newspapers, radio stations and cable television stations. The purpose of the scoping meeting was to receive public input to help establish the scope, framework, and approach to the transportation alternatives analysis. During the meeting, the project's background and history, 11 proposed alternatives, the study process and the schedule were described. The meeting was then opened for oral and written comments. Approximately 30 local government representatives and interested citizens attended. Written comments were accepted from January 8, 1987 through February 28, 1987.

In March 1987, 23 interviews were conducted with civic and community leaders regarding the transportation alternatives. Civic and community leaders were asked about their perceptions of the advantages and disadvantages of transit vehicle choices and 11 proposed transportation system alternatives. In addition, they were asked which alternative might be most acceptable by the corridor community residents. Interview respondents were also asked to identify the critical environmental, social and financial considerations which should be examined in the alternatives analysis and evaluation.

The interview participants included representatives from the cities in the Corridor--Martinez, Concord, Pittsburg, Antioch, and Brentwood--as well as the community of West Pittsburg. Unincorporated communities were also represented by Contra Costa County officials. Interview respondents included city councilpersons, city managers, planning directors, public works directors, representatives from community organizations and interest groups, Chamber of Commerce members, county supervisors, members of the business and real estate communities and residents.

Three community workshops were held in March 1987. Two of the workshops were held in the City of Antioch (March 19 and 26, 1987) and one was held in the City of Concord (March 18, 1987). Notification of the workshops was provided in local newspapers and in the project newsletter, the "Corridor Update," which was inserted into the four major newspapers serving the west, central and east sections of the corridor. In addition, a special letter of invitation and the "Corridor Update" newsletter was also sent to each of the corridor city's councilmembers, planning commissioners, city staff, and planning officials.

The purpose of the workshops was to involve corridor residents in the identification of major transportation planning issues that should be addressed in the alternatives analysis. The participants were also asked to discuss the advantages and disadvantages of the initial 11 proposed alternatives.

A second round of community workshops on the project was held in August 1987. Two of the workshops were held in the City of Antioch (August 5 and 13, 1987) and the other was held in the City of Concord (August 6, 1987). Notification of the workshops was provided in local newspapers and in the project newsletter, the "Corridor Update," which was inserted into the four major newspapers serving the west, central, and east sections of the corridor. In addition, a special letter of invitation and the "Corridor Update" was sent to civic and community leaders and city staff.

The purpose of the second round of workshops was to provide corridor residents an opportunity to review and compare the seven primary transportation alternatives that were derived from the initial 11 proposed transportation alternatives. The workshops were designed to elicit corridor residents' perception of the relative suitability of the various alternatives and to see how they could be modified or "strengthened" as alternatives for study purposes.

6.2 INPUTS FROM CITIZEN PARTICIPATION

During the various meetings, interviews, and workshops, the citizens and community and civic leaders provided comments on the project. Following is a brief summary of the comments provided on the project.

Comments provided during the scoping meeting and scoping comment period can be grouped in the three categories: (1) transportation alternatives; (2) evaluation criteria; and (3) environmental issues. The participants expressed that the following concerns should be addressed in the study:

- Give adequate consideration to a wide range of vehicle types and alignment combinations.

- Provide a clear rationale for selection of the transportation alternatives which will be studied.

- Include criteria to evaluate alternatives such as estimated fare rates and overall user convenience.

- Identify and analyze environmental issues relating to biotic communities, air quality, water quality, and public utilities.

During interviews that were administered to civic and community leaders, various views were provided on the project. The general views of the interview respondents about the advantages and disadvantages of the transit vehicle choices (bus, light rail, and BART) were as follows:

- **Bus transit** was viewed by some as popular only in Concord and much less appealing in other areas of the corridor. It was considered a low costs, short-term solution that would minimally improve the transportation problem.

- **Light rail** was deemed a more realistic solution compared to BART, very popular with the public, and faster with more frequent service than buses. The City of Pittsburg and the County would be the most vocal proponents for light rail. Concerns raised over light rail included the inconvenience of transferring from one mode to another, appearance of overhead wires and possible conflicts with traffic at grade level crossings.

- **BART** was supported by some because it is the continuation of the existing system, removes the need to transfer, offers higher speed travel and is appealing to users. High costs, inflexibility of routes and lack of transit (feeder buses, etc.) at destinations were identified as significant disadvantages.

Comments on environmental issues were also provided during the interviews. Respondents felt that the new growth spurned by improved transportation might result in negative environmental impacts. Some agreed that such adverse impacts could be mitigated or avoided with careful planning and management.

Respondents raised several social issues relating to the implementation of a transportation alternative. Some thought that such a system could split communities, causing a "good" and "bad side of the tracks" relationship. Construction could also displace residential and commercial areas and result in the loss of affordable housing located in or near rights-of-way.

Financial considerations were also mentioned by several respondents. Costs of a new transportation system were identified as a major problem to be addressed. Some noted that it is assumed that any effective system would involve large amounts of public money. Others commented, however, that improved transportation would significantly enhance economic development by generating a larger tax base, revitalizing downtowns, and attracting jobs.

Major transportation planning concerns were identified during the March 1987 workshops. The major concerns for evaluating transportation alternatives in the corridor were identified as follows:

- Reduce congestion and commute times.
- Simplify intermodal transfer.
- Improve parking.
- Minimize environmental impact.
- Develop a phased transit improvement plan.
- Disseminate information about BART plans.
- Be cost-effective.
- Desirable features of a transit system.

The workshop participants also identified the advantages and disadvantages of the initial 11 transportation alternatives. The BART alternatives were identified as providing an improvement on commuting times and a reduction in traffic; however, these alternatives were identified as too expensive. The LRT alternatives were identified as feasible transportation alternatives but may reduce the visual quality within the corridor due to station and rail structures. The HOV alternative was identified as a short term solution to traffic; however, it would accommodate a low volume of passengers. The TSM alternative was also identified as a short term solution to traffic; however, this alternative could encourage more traffic. Finally, the No Build alternative was identified as saving money; however, it would not provide necessary transportation improvements.

In the second round of community workshops held in August 1987, the workshop participants reviewed and compared the seven transportation alternatives derived from the original 11 alternatives. In comparing the seven primary alternatives, the comments provided by the workshop participants were grouped in four criteria. The criteria were: (1) increased mobility; (2) financial feasibility; (3) economical employment opportunities; and (4) environmental quality. The participants identified the BART and LRT alternatives as providing a significant increase in mobility while the HOV, TSM, and No Build alternatives would not significantly increase mobility.

The LRT alternatives were identified as the most cost effective while the BART alternatives were identified as too expensive. The BART and the LRT to Antioch via State Route 4 alternatives were identified as providing beneficial effects to economic development. The LRT to Antioch via SPTC alternative and the HOV, TSM and No Build alternatives were identified as providing little or no beneficial effect to the general economic development. Except for the No Build Alternative, the participants identified all the alternatives as providing a reduction in traffic and air pollution. The LRT and BART alternatives were also identified as providing adverse visual affects due to station and rail structures.

The seven primary alternatives were subsequently expanded to 12 alternatives based on possible funding constraints. The additional five alternatives examined minimal fundable segments for the previously defined HOV, LRT and BART transportation alternatives.

Additional community involvement will occur throughout the remaining portions of the project. The Board of Control and Technical Advisory Committee will continue to meet to review and approve technical documents. After the Draft Environmental Impact Report (DEIR) is distributed to the public, additional environmental concerns regarding the project can be provided during the public review period of the draft EIR. The process will continue with the Board of Control selecting the locally preferred alternative and the Bay Area Rapid Transit District Board of Directors considering certification of the final EIR.

SECTION 7

REFERENCES

Aasen, Kelly. U.S. Army Corps of Engineers. Personal communication with Chris Valentino (BEI) on May 29, 1987.

ABAG--See Association of Bay Area Governments.

Abrams, L. 1923. Illustrated Flora of the Pacific States. Stanford University Press, Stanford, California. 4 Volumes.

Adams, Mike. Research Analyst, California State Controller's Office. Personal communication on June 22, 1987.

Advisory Council on Historic Preservation. 1986a. 36 CFR Part 800: Protection of Historic Properties Regulations of the Advisory Council on Historic Preservation Governing the Section 106 Review Process. Effective October 1, 1986. Publication available from the State Historic Preservation Office. Sacramento.

Advisory Council on Historic Preservation. 1986b. Section 106, Step by Step. Issued October 1986. Publication available from the State Historic Preservation Office. Sacramento.

Aiello, Marty. 1987. Personal communication. Board Member of the Pittsburg Historical Society.

American National Standards Institute. 1960. "Acoustical Terminology."

American National Standards Institute. 1969. "Preferred Reference Quantities for Acoustical Levels."

American National Standards Institute. 1983a. "Guide for the Evaluation of Human Exposure to Vibration in Buildings."

American National Standards Institute. 1983b. "Specifications for Sound Level Meters."

American Ornithologists' Union (AOU). 1983. The A.O.U. Check-List of North American Birds. 6th ed. Allen Press, Lawrence, Kansas. 877 pp.

American Public Transit Association (APTA). 1979. "Guidelines for Design of Rapid Transit Facilities."

Andrews, M. 1986. History of Concord--Its Progress and Promise. Concord Historical Society. Concord.

Antioch, City of. Adopted 1975, consolidated 1981. Noise Element to General Plan.

Antioch, City of. 1975. City of Antioch General Plan, April.

Antioch, City of. 1981. City of Antioch General Plan.

Antioch, City of. 1982. Southeast Specific Plan.

Antioch, City of. 1986a. Draft EIR for Redevelopment Project No. 3.

Antioch, City of. 1986b. Antioch.

Antioch, City of. 1988a. Commercial Projects and Land.

Antioch, City of. 1988b. Residential Project Status Sheet.

Antioch, City of. Municipal Code IX.5.413.1, Flooding and Flood Fringe Combining District.

Axelrod, D.I. 1978. "The Origin of Coastal Sage Vegetation, Alta and Baja California." Amer. J. Bot. 65(10):1117-1131.

Association of Bay Area Governments (ABAG). 1987. Projections 87.

Bagwell, Sergeant. Pittsburg Police Department. Letter received on September 14, 1987.

Bailey, Linda. Contra Costa County Flood Control. Personal communication Chris Valentino (BEI) on May 28, 1987.

BARTD--See Bay Area Rapid Transit District.

Basin Research Associates, Inc. 1983. An Archaeological Resources Assessment of the Proposed Wirth and Company Concord Center Office Complex, City of Concord, Contra Costa County, California. Report on file at California Archaeological Inventory-Northwest Information Center, Sonoma State University. Rohnert Park.

Bay Area Air Quality Management District (BAAQMD). 1985. Air Quality and Urban Development. San Francisco.

Bay Area Rapid Transit District (BARTD). 1981. Aerial/At-Grade Alignment Feasibility Study Along State Route 4 for the BART Pittsburg-Antioch Extension. Oakland: Bay Area Rapid Transit District. October.

Bedell, Bob. City of Pittsburg. Personal communication on July 27, 1987.

Bennyhoff, J. 1977. Ethnogeography of the Plains Miwok. University of California Center for Archaeological Research at Davis, Publications, 5. Davis.

Borunda, Michael. Human Resources Department, City of Pittsburg. Personal communication on May 2, 1988.

Brabb, E. E., and others. 1976. "Preliminary Geologic Map of Contra Costa County."

Brentwood, City of. 1983. City of Brentwood General Plan Land Use Element.

Brotman, Jeff. Analyst, MacMasters and Westland Realty. Personal communication on June 11, 1987.

Brown and Caldwell Engineering. 1971. Contra Costa County Water Quality Study. Draft Report. Prepared for the Contra Costa County Water Agency.

Bruchay, Roger. Delta Diablo Sanitation District. Letter written to Michael Houlihan on September 29, 1987.

Burke, D. B., and E. J. Helley. 1973. "Map showing Evidence for Recent Fault Activity in the Vicinity of Antioch, Contra Costa County, California." USGS Miscellaneous Field Studies Map, MF-533.

Burkland and Assoc. 1975. "Geologic and Seismic Hazards Investigation-Fourteen Parcels, Antioch, California."

California Department of Fish and Game (CDFG). 1980. At the Crossroads: A Report on the Status of California's Endangered and Rare Fish and Wildlife. State of California Resources Agency, Sacramento, California. 147 pp. + Addenda.

California Department of Fish and Game (CDFG). 1986. "Endangered, Rare and Threatened Animals of California." State of California Resources Agency, Sacramento, California. Photocopied list. 4 pp.

California Department of Fish and Game (CDFG). 1987. "Designated Endangered or Rare Plants." Summary list from Section 1904, Fish and Game Code (Native Plant Protection Act). State of California Resources Agency, Sacramento, California. 5 pp.

California Natural Diversity Data Base (CNDDB). 1987. Data Base Record Search for Information on Threatened, Endangered, Rare or Otherwise Sensitive Species and Communities. California Department of Fish and Game, State of California Resources Agency, Sacramento, California.

California, State of. Division of Mines and Geology. 1974. "Special Studies Zones for Walnut Creek Quadrangle."

California, State of. Division of Mines and Geology. 1976a. "Special Studies Zones for Antioch North Quadrangle."

California, State of. Division of Mines and Geology. 1976b. "Special Studies Zones for Antioch South Quadrangle."

California, State of. Division of Mines and Geology. 1977. "Special Studies Zones for Port Chicago Quadrangle."

California, State of. Board of Equalization. 1975 and 1985. Taxable Sales in California, Annual Report.

California, State of. Department of Finance. 1977 and 1982. California Statistical Abstracts.

California, State of. Department of Parks and Recreation. 1976. California Inventory of Historic Resources. Published by the Resources Agency. Sacramento.

California, State of. Department of Parks and Recreation. 1982. California Inventory of Historic Landmarks. Published by the Resources Agency. Sacramento.

California, State of. Department of Public Works, Division of Water Resources. 1986. "Water Quality Investigation by the Central Valley Regional Water Pollution Control Board on Marsh Creek."

California, State of. Department of Water Resources (DWR). 1978. Preliminary Report - Faults and Seismicity at Los Vaqueros Dam Site.

California, State of. Employment Development Department. 1986. Annual Planning Information, Contra Costa County, 1986-1987.

California, State of. Office of the Controller. 1984-1985. Counties of California Financial Transactions Annual Report.

California, State of. Office of the Controller. 1984-1985. Financial Transactions Concerning Cities of California.

California, State of. California State Lands Department. Bureau of Land Management and Ecology and the Environment. 1986. San Joaquin Valley Pipeline, Draft Environmental Impact Report and Environmental Impact Statement.

Coldwell Banker. 1986. East Bay Office.

Concord, City of. 1976. Central Concord Redevelopment Plan.

Concord, City of. Adopted 1979, and amended 1985. "Concord General Plan: 1980, Chapter 3.6 - Noise Element."

Concord, City of. 1982 and amended in 1984. Concord General Plan Map.

Concord, City of. 1984. Concord General Plan Development and Land Use Element.

Corcord, City of. 1984. Municipal Code 1X.1(3) Flood Insurance Program.

Concord, City of. 1985a. North Todos Residential Density Study.

Concord, City of. 1985b. North Todos Santos Specific Plan.

Contra Costa County. 1871. Topographic Map of Contra Costa County: Compiled for the Board of Supervisors from the State Geological and United States Surveys. Map on file at the California Historical Society Library. San Francisco.

Contra Costa County. 1975. Noise Element to General Plan.

Contra Costa County. 1986. Central Landfill DEIR.

Contra Costa County. 1986. "DEIR, West Pittsburg Area," County File #16-85-CO, sponsored by Pacific National GPA (Dynasty).

Contra Costa County. 1986. Summary of Agency Plans and Programs.

Contra Costa County. 1986. Draft Environmental Report: Pacific National GPA (Dynasty) West Pittsburg Area.

Contra Costa County. 1987. "Environmental Overlay System."

Contra Costa County Community Development Department (CDD). 1975. Seismic Safety Element - Technical Background Report.

Contra Costa County Community Development Department (CDD). 1985. Growth Trends.

Contra Costa County Community Development Department (CDD). 1986a. Recent and Pending Residential Development in West Pittsburg.

Contra Costa County. Community Development Department (CDD). 1986. Summary of City and County General Plans.

Contra Costa County Community Development Department (CDD). 1987. Growth Trends.

Contra Costa County Community Development Department (CDD). 1988. Recent Growth in Contra Costa County, the San Francisco Bay Area, and California.

Contra Costa County 1988 Ordinance No. 87-65, (revised as No. 88-50) Floodplain Management.

Dalecki, Chuck. California Highway Patrol-Martinez. Personal conversation on October 5, 1987.

Dibblee, T. W. Jr. 1980a. Preliminary Geologic Map of the Antioch South Quadrangle, Contra Costa County, California.

Dibblee, T. W. Jr. 1980b. Preliminary Geologic Map of the Honker Bay Quadrangle, Solano and Contra Costa Counties, California.

Dibblee, T. W. Jr. 1980c. Preliminary Geologic Map of the Walnut Creek Quadrangle, Contra Costa County, California.

Dibblee, T. W. Jr. 1981. Preliminary Geologic Map of the Port Chicago Quadrangle, Solano and Contra Costa Counties, California.

Eastern Contra Costa Transit Authority--see Tri-Delta Transit.

Earth Sciences Assoc., with EDAW Inc. 1976. Geologic (Seismic) Hazards and Public Safety Element for the City of Concord, California.

Economics Research Associates. 1983 and updated in 1985. Downtown Concord Study Area Market Analysis. Prepared for Concord Redevelopment Agency.

ENGEO Inc. 1978. "Report to Mrs. Anna B. Coller for Property at "C" Street and Railroad Avenue, Antioch, California on Alquist-Priolo Investigation."

Federal Register, Vol. 43 No. 29, February 19, 1978, 11988 Floodplain management.

Fredrickson, D. 1964. Archaeological Investigations Near Alamo, Contra Costa County, California: CCo-308. Manuscript on file at the California Department of Parks and Recreation. Sacramento.

Fredrickson, D. 1965. Recent Excavations in the Interior of Contra Costa County, California. Sacramento Anthropological Society Papers 3:18-25. Sacramento.

Fredrickson, D. 1966. CCo-308: The Archaeology of a Middle Horizon Site in Interior Contra Costa County, California. M.A. Thesis. Department of Anthropology, University of California. Davis.

Fredrickson, D. 1968. Archaeological Investigations at CCo-30 Near Alamo, Contra Costa County, California. University of California, Center for Archaeological Research at Davis, Publications 1. Davis.

Fredrickson, D. 1969. Technological Change, Population Movement, Environmental Adaptation, and the Emergence of Trade: Inferences on Culture Change Suggested by Midden Constituent Analysis. University of California, Los Angeles, Archaeological Survey Annual Report, 1968-1969: 101-125. Los Angeles.

Gabrysiak, Chuck. Principal Planner, City of Concord. Personal communication on April 21, 1988.

Gabrysiak, Chuck. City of Concord Planning Department. Letter to Thomas Fitzwater on July 9, 1987.

Golick, David. Planner, City of Concord Planning Department. Personal communication on April 13, 1988.

Grillo, Carl. Contra Costa Water District. Letter written to Michael Houlihan on September 16, 1987.

Grubb & Ellis. 1987. Bay Area Counties Real Estate 1987.

Harding-Lawson Assoc. 1978. Geologic Investigation - Service Station Site - A Street and Rossi Avenue, Antioch, California.

Helley, E. J., and D. G. Herd. 1977. "Map Showing Faults with Quaternary Displacement, Northeastern San Francisco Bay Region, California." USGS Miscellaneous Field Studies Map, MF-881.

Henderson, Robert. Lieutenant, Contra Costa County Sheriff's Department. Letter written to Michael Houlihan on September 14, 1987.

Herd, D. G., and E. J. Helley. 1977. "Faults with Quaternary Displacement, Northwestern San Francisco Bay Region, California." USGS Miscellaneous Field Studies Map, MF-818.

Hoover, M. B., H. E. Rensch, and E. G. Rensch. 1966. Historic Spots in California. Stanford University Press. Stanford.

International Organization for Standardization. 1974. "Guide for the Evaluation of Human Exposure to Whole-Body Vibration," with Addendum 2, "Vibration and Shock Limits of Occupants in Buildings."

Jennings, M. R. 1983. "An Annotated Check List of the Amphibians and Reptiles of California." California Fish and Game 69(3):151-171.

Jerome, Randy. Planning Analyst, City of Pittsburg Planning Department. Personal communication on June 24, 1987.

Jones, J. K., Jr., D. C. Carter, H. H. Genoways, R. S. Hoffman, and D. W. Rice. 1982. "Revised Checklist of North American Mammals North of Mexico, 1982." Occas. Pap. Mus. Texas Tech Univ., No. 80.

Kartesz, J. T., and R. Kartesz. 1980. A Synonymized Checklist of the Vascular Flora of the United States, Canada, and Greenland. Volume II. The Biota of North America. The University of North Carolina Press, Chapel Hill. 498 pp.

Kelly, Jim. Central Contra Costa Sanitary District. Personal conversation on October 2, 1987.

King, T. F., M. J. Moratto, and N. N. Leonard III. 1973. Recommended Procedures For Archaeological Impact Evaluation. Published Jointly by the Society of California Archaeology and the University of California. Los Angeles.

Kroeber, A. 1925. Handbook of the Indians of California. Smithsonian Institution, Bureau of American Ethnology Bulletin, 78. Washington, DC.

Kroll, Cynthia A. 1986. Suburban Squeeze II: Responses to Suburban Employment Growth.

Kurasaki, Joye. Associate Engineer, Central Contra Costa Sanitary District. Letter written to Michael Houlihan on October 5, 1987.

Larry Seeman Associates, Inc. 1986. Draft EIR: Baker Property General Plan Amendment.

Lawson, A. C. 1914. "U.S. Geol. Survey Atlas," S.F. Folio No. 193.

Leonard, Dick. Superintendent, California Cities Water. Letter received on September 10, 1987.

Leubner, Jim. City of Concord. Letter written on September 28, 1987.

Levy, R. 1978. Eastern Miwok. In Handbook of North American Indians, Volume 8:398-413. R. F. Heizer, editor. Smithsonian Institution. Washington, DC.

Lewis, David. Lieutenant, Antioch Police Department. Letter written to Michael Houlihan on September 10, 1987.

Lillard, J. B., R. F. Heizer, and F. Fenenga. 1939. An Introduction to the Archaeology of Central California. Sacramento Junior College, Department of Anthropology Bulletin, 2. Sacramento.

Linse, Janet. Planner, City of Concord Planning Department. Personal communication on July 17, 1987.

Loud, L. L. 1913. Walnut Creek Mounds Nos. 419-428. Archaeological Research Facility, Department of Anthropology, University of California, Manuscript No. 366. Berkeley.

Lynch, S. M. Sergeant, City of Concord Police Department. Letter written to Michael Houlihan on October 2, 1987.

Martinez, City of. 1973. Central Martinez General Plan.

McCallum, John. Planner, MTC. Personal communication on July 9, 1987.

McGill, Evelyn. Research Analyst, California Employment Development Department. Personal communication on June 23, 1987.

McMahon, T. A. 1908. Official Map of Contra Costa County, California. Compiled from Private Surveys and Official Records. Map on file at the California Historical Society Library. San Francisco.

Mead, R., and J. Moss. 1967. Report on the Salvage of CCo-311. Manuscript on file at the R. H. Lowie Museum of Anthropology, University of California. Berkeley.

Metropolitan Transportation Commission (MTC). 1988. I-680/I-580 Corridor Study. Draft.

Milliken, R. 1982. An Ethnographic Study of the Clayton Area, Contra Costa County, California. In Cultural Resources Evaluation of Keller Ranch, Clayton, California. Holman and Associates. San Francisco.

Mizuno, Francis. EBMUD. Person Communication with Chris Valentine (BEI) on April 1, 1988.

Molton, Linda. Cartographer, Contra Costa County Planning Department. Personal communication on June 12, 1987.

Moratto, M. J. 1984. California Archaeology. Academic Press, Inc., New York.

Mundie & Associates. 1988. "Concord BART Station Area, Amendment to the Concord Redevelopment Plan DEIR," prepared for the City of Concord and sponsored by BARTD.

Mundie & Associates and City of Concord. 1988. Draft EIR, Concord BART Station Area.

Munz, P. A., and D. D. Keck. 1959. A California Flora. University of California Press, Berkeley, California. 1681 pp.

National Research Council. Committee on Hearing, Bioacoustics and Biomechanics (CHABA), Assembly of Behavioral and Social Sciences. Working Group 69. 1977. "Guidelines for Preparing Environmental Impact Statements on Noise."

National Register of Historic Places. 1979. Federal Register, 44:26; Department of Interior, National Park Service (February 1979; and March 1980, February 1981, February 1982, March 1983, February 1984, March 1985 and February 1986 Federal Register Updates).

Nelso, Patricia. Contra Costa Water District. Personal Communication with Chris Valentino (BEI) on May 28, 1987.

Niehaus, T. F., and C. L. Ripper. 1976. A Field Guide to Pacific States Wildflowers. Houghton Mifflin Company, Boston, Massachusetts. 432 pp.

Nilsen, T. H. 1971. "Preliminary Photointerpretation Map of Landslide and Other Surficial Deposits of the Mount Diablo Area, Contra Costa and Alameda Counties, California." USGS Miscellaneous Field Studies Map, MF-310.

Nilsen, T. H. 1973. "Preliminary Photointerpretation Map of Landslide and Other Surficial Deposits of the Concord 15-minute Quadrangle and the Oakland West, Richmond, and Port of San Quentin 7-1/2-minute Quadrangle, Contra Costa and Alameda Counties, California." USGS Miscellaneous Field Studies Map, MF-493.

Northern California Real Estate Journal. "Retail Survey Shows Demand" and "Cheap Rent for Steel Users," June 8-June 21, 1987 and "Showing Off Its Space," February 29, 1988.

O'Banion, Kerry. BART Joint Development. Personal communication on April 11, 1988.

Okeda, Dale. Contra Costa County Environmental Department. Personal communication with Chris Valentine (BEI) on May 28, 1987.

Parfrey, Eric. Senior Planner, Contra Costa County Planning Department. Personal communication on June 16, 1987.

Pittsburg, City of. City of Pittsburg Noise Ordinance. Chapter 9.44, City Code.

Pittsburg, City of. 1980. City of Pittsburg General Plan.

Pittsburg, City of. 1986. Downtown Specific Plan.

Pittsburg, City of. 1987. Number of Residential Units by Type and Status.

Pittsburg, City of. 1988. Noise Element to General Plan.

Pittsburg, City of. 1987 (Sept). Municipal Code Chapter 15.80, Flood Hazard Prevention, and Ordinance No. 87-933.

Pittsburg-Antioch BART Extension Board of Control. 1976. Final Report: Pittsburg-Antioch BART Extension Project. Prepared by Parsons Brinckenhoff-Tudor-Bechtel (San Francisco, California) in association with Wilbur Smith and Associates and Ingmire/Patri, Inc.

Pride, Lillian. City of Pittsburg. Personal communication on July 23, 1987.

Raycraft, Jerry. Contra Costa County Planning Department. Personal communication on May 11, 1988.

Raycraft, Jerry. Contra Costa County Planning Department. Personal communication on June 24, 1987.

Reiche, P. 1950. "Rio Vista, California, Fault Scarp," Geol. Soc. Amer. Bull. Vol. 61.

Remsen, J. V. 1978. "Bird Species of Special Concern in California: An Annotated List of Declining or Vulnerable Bird Species." Nongame Wildlife Investigations, Wildlife Management Branch, California Department of Fish and Game. Administrative Report No. 78-1. 54 pp.

Robbins, W. W., M. K. Bellue, and W. S. Ball. 1951. Weeds of California. State of California Department of Agriculture. 547 pp.

Rocha, Tony. Contra Costa Water District, Personal Communication with Chris Valentine (BEI) on April 4, 1988.

Sanborn Map Company, New York. Sanborn Insurance Maps--Antioch: 1884, 1888, 1891, 1896, 1900, 1908, 1912 and 1926.

Sanborn Map Company, New York. Sanborn Insurance Maps--Concord: 1891, 1897, 1903, 1908, 1912, 1917 and 1926.

Sanborn Map Company, New York. Sanborn Insurance Maps--Pittsburg: 1911, 1917 and 1927.

Saurenman, H. J., D. A. Towers, and C. E. Hanson. 1986. Noise Analysis of Selected Rail Corridors for the Proposed ATSF/SPT Merger. Report #260140-1 prepared by HHMH, Inc. for Interstate Commerce Commission.

Security Pacific Bank. 1985. Construction Trends.

Seed, H. B., and I. M. Idriss. 1971. "Simplified Procedure for Evaluation Soil Liquefaction Potential," Jour. Soil Mech. and Found. Div. ASCE, SM9.

Sharp, R. V. 1973. "Map Showing Recent Tectonic Movement on the Concord Fault, Contra Costa and Solano Counties, California." USGS Miscellaneous Field Studies Map, MF-505.

Silva, Inspector. Consolidated Fire District. Letter dated September 16, 1987.

Sims, J. D., and T. H. Nilsen. 1972. "Preliminary Photointerpretation Map of Landslide and Other Surficial Deposits of Parts of Pittsburg and Rio Vista 15-minute Quadrangles, Contra Costa and Solano Counties, California." USGS Miscellaneous Field Studies Map, MF-322.

Sims, J. D., and others. 1973. "Preliminary Geologic Map of Solano County and Parts of Napa, Contra Costa, Marin and Yolo Counties, California." USGS Miscellaneous Field Studies Map, MF-484 (Sheet 5 of 5).

Smith, J. P., Jr., and R. York. 1984. Inventory of Rare and Endangered Vascular Plants of California. Special Publication No. 1 (3rd Edition), California Native Plant Society. 174 pp.

Strauss, Martin. Planning Analyst, City of Pittsburg Planning Department. Personal communication on June 17, 1987.

Thude, Larry. Senior Fire Inspector, Riverview Fire Protection District. Letter written to Michael Houlihan on October 2, 1987.

Tillman, Linda. City of Pittsburg Redevelopment Agency. Personal communication on April 29, 1988.

Tolman, C. 1931. Geology of Upper San Francisco Bay - Economic Aspects of a Salt Water Barrier. California Department of Water Resources, Bull. 28.

Tri-Delta Transit/BARTD. 1981. Draft Eastern Contra Costa Light Rail Transit Study. Prepared by Wilbur Smith and Associates and DeLeuw, Cather and Co., for the Eastern Contra Costa Transit Authority (Antioch, California) and the Bay Area Rapid Transit District. August.

U.S. Department of Agriculture. Soil Conservation Service. With University of California Agricultural Experiment Station. (USDA-SCS). 1977. "Soil Survey of Contra Costa County, California."

U.S. Department of Commerce. Bureau of the Census. 1970 and 1980. Census of Population and Housing: Census Tracts, San Francisco-Oakland, California.

U.S. Department of Commerce. Bureau of the Census. 1977 and 1982. Census of Service Industries.

U.S. Department of Commerce. Bureau of the Census. 1977 and 1982. Census of Retail Trade.

U.S. Department of Commerce. 1983. Climate Atlas of the United States.

U.S. Department of Transportation. November 1984. A Baltimore Region Transit Study: Northeast Corridor Alternatives Analysis/Draft Environmental Impact Statement, Volume 1, Draft Environmental Impact Statement.

U.S. Environmental Protection Agency. 1974. "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety."

U.S. Environmental Protection Agency. 1985. Compilation of Air Pollutant Emission Factors. Volume II: Mobile Sources. Office of Mobile Sources, AP-42, 4th Ed.

U.S. Fish and Wildlife Service (FWS). 1987. Endangered and Threatened Wildlife and Plants. Federal Register 50 CFR 17.11 and 17.12. U.S. Department of the Interior, Reprint. 13 pp.

U.S. Geological Survey (USGS). 1980. "Honker Bay Quadrangle," 7.5-minute series.

U.S. Geological Survey (USGS). 1984. Surface Water Quality.

Wallace, David. City of Martinez Planning Department. Personal communication on April 14, 1988.

Wallace, R. E. 1970. Earthquake Recurrence Intervals on the San Andreas Fault. Geol. Soc. Amer. Bull. Vol. 81.

Weaver, C. E. 1949. "Geology of the Coast Ranges Immediately North of the San Francisco Bay Region." Geol. Soc. Amer. Mem. 35.

Westec Services, Inc. 1987. Mt. Diablo Hospital Medical Center Helipad EIR. Prepared for the City of Concord.

White, D. W. Bechtel Civil, Inc. Interoffice memorandum to J. Yonekura. Dated May 25, 1987.

Witchel, Dick. RWQCB. Personal communication with Chris Valentine (BEI) on May 29, 1987.

Wilkenson, Paul. City of Antioch. Letter written to Michael Houlihan on October 6, 1987.

Wilson, Ihrig & Associates, Inc. 1973. "BARTD Aerial Structure Sound Barrier Wall Noise Tests." Letter from G. P. Wilson to Mr. J. Asmus, PBTB.

Wilson, Ihrig & Associates, Inc. 1980. "Measurement of Ground-Borne Vibration at BART March 1980." Technical memorandum from H. J. Saurenman to Department of Transportation, Transportation Systems Center.

Wilson, Ihrig & Associates, Inc. 1984. "Guadalupe Corridor Final Design LRT Noise and Vibration Base Data." By S. L. Wolfe and H. J. Saurenman.

Wilson, Ihrig & Associates, Inc. 1987a. "Additional Noise and Vibration Data Concording Proposed Metro Rail Sunset Boulevard Alignment." Letter from J. C. Shearer and R. A Carman to Mr. N. Tahir, Southern California Rapid Transit District.

Wilson, Ihrig & Associates, Inc. 1987b. "Noise and Vibration Testing along North Line Guadalupe Corridor Project." Letter from J. C. Shearer to Mr. W. Michelutti, PBQ&D.

SECTION 8

LIST OF PREPARERS

8.1 PUBLIC AGENCIES

BAY AREA RAPID TRANSIT DISTRICT—LEAD AGENCY

Bay Area Rapid Transit District
800 Madison Street
Oakland, California 94604-2688

Richard C. Wenzel, Manager of Planning; Project Director
Alan E. Lee, Senior Extension Planner; Project Manager

METROPOLITAN TRANSPORTATION COMMISSION—COOPERATIVE AGENCY

Metropolitan Transportation Commission
Metrocenter
101 8th Street
Oakland, California 94607

Patrick Hackett, Senior Systems Analyst; Computer programming in support of travel demand forecasts.
Al Huerby, Senior Financial Analyst; Assisted in travel demand forecasts.
Hana Kollo, Senior Transportation Planner/Analyst; Managed travel demand forecasts.
Chuck Purvis, Associate Transportation Planner/Analyst; Assistant Manager of travel demand forecasts.
Jeff Georgevich, Associate Planner; Environmental Review
Ron West, Assistant Transportation Planner/Analyst; Network development and assignment for travel demand forecasts.

8.2 CONSULTANTS

BECHTEL CIVIL, INC.—OVERALL PROJECT MANAGEMENT/ENGINEERING; PREPARED HYDROLOGY AND WATER QUALITY AND AIR QUALITY ANALYSIS

Bechtel Civil, Inc.
45 Fremont Street
San Francisco, California 94105

David W. White, M.S., M.B.A.; Project manager in charge of the consulting team and participated in the preparation of all sections.
Horace E. Harrison, M.S., P.E.; Deputy Project Manager and Project Engineer for the consulting team; led preparation of the engineering and capital cost estimating section.
Tim Morgan, B.S.; participated in the preparation of the air quality sections.

Susan Naughton, M.A.; participated in the review of energy, air quality, and hydrology and water quality sections.
Esa J. Rasi, M.A.; participated in the preparation of the capital cost sections.
James A. Slater, B.S.; prepared the energy analysis section.
Christian Seigneur, Ph.D.; participated in the preparation of the air quality sections.
Christopher Valentino, M.S.; prepared the hydrology and water quality sections.
Janice S. Yonekura, D. Env.; coordinated the energy, air quality, and hydrology and water quality sections.

MICHAEL BRANDMAN ASSOCIATES, INC.—MANAGED ENVIRONMENTAL STUDIES/PREPARED LAND USE, NEIGHBORHOODS, PARKLANDS, PUBLIC SERVICES AND UTILTIES, AND ECOSYSTEMS ANALYSIS

Michael Brandman Associates, Inc.
2530 Red Hill Avenue
Santa Ana, California 92705

Curtis E. Alling, M.A., AICP; Project Director; directed environmental study.
Thomas W. Fitzwater, M.A., AICP; Project Manager; managed environmental document preparation and participated in the quality control of all environmental sections.
Diane Galin-Johnson, B.F.A; managed preparation of graphics.
Michael E. Houlihan, B.S.; participated in the preparation of the land use, neighborhoods and public services and utilities sections.
Gary D. Jakobs, B.A.; participated in the preparation of the parklands section.
William P. Magdych, Ph.D.; participated in the preparation of the ecosystems section.
Thomas E. Smith, Jr., M.A., AICP, Principal-in-Charge; participated in overall report review.

BARTON ASCHMAN ASSOCIATES, INC.—PREPARED TRANSPORTATION ANALYSIS

Barton-Aschman Associates
100 Park Center Plaza, Suite 450
San Jose, California 95113

William A. Davidson, B.S., Project Manager; supervised review of travel forecasts and transportation analysis.
At van de Hout, B.S.; participated in transportation impact analysis.
Norm Steinman, M.C.P., AICP, Project Transportation Planner; managed transportation impact analysis.

DAVID CHAVEZ AND ASSOCIATES—PREPARED CULTURAL RESOURCE ANALYSIS

David Chavez and Associates
P.O. Box 52
Mill Valley, California 94941

David Chavez, M.A., consultant for cultural resources studies; managed all cultural resources sections.
Sally B. Woodbridge, Ph.D. Candidate, consultant for cultural resources studies; participated in the preparation of the historic properties section.

EDAW, INC.—PREPARED VISUAL QUALITY AND AESTHETICS ANALYSIS

EDAW, Inc.
1725 Montgomery Street
San Francisco, California 94111

Thomas Packard, MLA, Associate; Principal Investigator and Project Manager for visual resources; developed methodology, conducted field studies, performed impact analysis, directed graphic production, primary author of visual resources report.
John A. Petrovsky, MLA, Senior Associate; participated in methodology development, reviewed and edited visual quality and aesthetics report and graphics.
Kyo Tochikura, MLA; produced visual simulation sketches of proposed facilities.

GEO RESOURCES CONSULTANTS, INC.—PREPARED GEOLOGY, SOILS, AND SEISMICITY ANALYSIS

Geo Resources Consultants, Inc.
851 Harrison Street
San Francisco, California 94107

Alan D. Tryhorn, C.E.G., Principal-in-charge; directed overall study and performed the review of Geology, Soils, and Seismic sections.
Scott, C. Nelson, B.S., participated in the preparation of the Geology, Soils and Seismic sections of the EIR.
Eva E. Vanek, B.S., participated in the preparation of the Geology, Soils and Seismic sections.

MOORE, IACOFANO, GOLTSMAN—CONDUCTED COMMUNITY INVOLVEMENT PROGRAM

Moore, Iacofano, Goltsman
1824-A Fourth Street
Berkeley, California 94710

Daniel Iacofano, Ph.D., AICP, Partner-in-Charge; supervised public involvement program and scoping process.
James Oswald, B.A., B.S., Project Manager; managed public involvement program and scoping process.

RECHT-HAUSRATH AND ASSOCIATES—PREPARED ECONOMIC ACTIVITY/ DEMOGRAPHICS ANALYSIS

Recht-Hausrath and Associates
1212 Broadway, Suite 1700
Oakland, California 94612

Marian F. Wolfe, Ph.D., Project Manager; managed and participated in the preparation of the Economic Activity/Demographics section.
John Lederer, M.C.P., participated in the preparation of the Economic Activity/Demographics section.

WILSON, IHRIG AND ASSOCIATES, INC.—PREPARED NOISE AND VIBRATION ANALYSIS

Wilson, Ihrig and Associates, Inc.
5776 Broadway
Oakland, California 94618

Steven L. Wolfe, M.S.; Project Manager of noise and vibration section.
Richard A. Carmen, Ph.D.; Project Engineer for noise and vibration section.
Ron Goldman, B.S.; assisted in preparation of noise and vibration section.

SECTION 9

LIST OF DEIR RECIPIENTS

9.1 FEDERAL AGENCIES

Army Corps of Engineers, San Francisco
Army Corps of Engineers, Sacramento
Environment Protection Agency, Region 9, San Francisco
Federal Highway Administration, Sacramento
Federal Highway Administration, San Francisco
House of Representatives, The Honorable George Miller, Washington, D.C.
National Park Service, Western Regional Office, San Francisco
Naval Weapons Station, Concord
U.S. Fish & Wildlife Service, Sacramento
Western Division, Naval Facilities Engineering Command, San Bruno

9.2 STATE AGENCIES

Air Resources Board, Sacramento
Highway Patrol, Sacramento
Highway Patrol, Martinez
State Assembly, The Honorable Robert J. Campbell, Sacramento
Transportation Commission, Sacramento
Caltrans, District IV, San Francisco
Caltrans - Planning, Sacramento
Coastal Conservancy, Oakland
Department of Boating and Waterways, Sacramento
Department of Conservation, Sacramento
Department of Fish and Game, Yountville
Department of Fish and Game, Rancho Cordova
Department of General Services, Sacramento
Department of Health Services, Sacramento
Department of Parks and Recreation, Sacramento
Department of Parks and Recreation, Monterey
Department of Water Resources, Sacramento
Department of Water Resources, The Reclamation Board, Sacramento
Native American Heritage Commission, Sacramento
Office of Historical Preservation, Sacramento
Public Utilities Commission, Sacramento
Public Utilities Commission, San Francisco
Public Works Board, Sacramento
Regional Water Quality Control Board, Oakland
Regional Water Quality Control Board, Sacramento
State Clearinghouse, Sacramento

9.3 LOCAL GOVERNMENTS

Association of Bay Area Government, Oakland
Central Contra Costa Sanitation District, Martinez
City of Antioch, City Council, City Manager, Planning Commission, and Planning Department
City of Berkeley, Design Review Board
City of Brentwood, Planning Department
City of Concord, City Council, Planning Commission, Planning Department, and Public Works
City of Martinez, Planning and Building Department
City of Oakland, Mayor, and Zoning Division
City of Pittsburg, City Council, Planning Commission, City Manager, Community Advisory Commission, Historic Resources Commission, and Planning Department
City of San Francisco, Chief Administrative Officer
Contra Costa Council, San Ramon
Contra Costa County, Administration, Martinez
Contra Costa County, Transportation and Community Development, Martinez
Contra Costa County, Consolidated Fire District, Pleasant Hill
Contra Costa County, Flood Control District, Martinez
Contra Costa County, Public Works, Martinez
Contra Costa County, Resource Conservation District, Concord
Contra Costa County, Water District, Concord
Oakley Municipal Advisory Committee, Oakley

9.4 LOCAL AGENCIES

Ambrose Recreation and Park District, Pittsburg
Antioch Unified School District, Superintendent, Antioch
Bay Area Air Quality Management District, San Francisco
Central Contra Costa County Transit Authority, Concord
Contra Costa Commission, College District, Martinez
East Bay Municipal Utilities District, Oakland
East Bay Regional Park District, Oakland
Highway 4 Task Force, East County BART Coalition, Pittsburg
Local Agency Formation Commission, Martinez
Metropolitan Transportation Commission, Oakland
Mt. Diablo Unified School District, Concord
Pittsburg Community Organizing Project, Pittsburg
Pittsburg Unified School District, Superintendent, Pittsburg
Riverview Fire District, Antioch
S.F. Bay Conservation and Development Commission, San Francisco
Superintendent of Schools, Pleasant Hill

9.5 NEIGHBORHOOD ASSOCIATIONS

Bay Harbor Park Neighborhood Association, Pittsburg
Clyde Citizen's Advisory Committee, Chairperson, Clyde
Holbrook Heights Community Association, Concord
Sun Terrace East Homeowners Association, Concord
West Pittsburg Alliance, Pittsburg
Woodland Hills Neighborhood Association, Pittsburg

9.6 OTHER RECIPIENTS

AC Transit, Oakland
Ambrose Lions Club, Pittsburg
Antioch Chamber of Commerce, Antioch
AT & SF Railway Company, Stockton
Brentwood Chamber of Commerce, Brentwood
Buchanan Field Airport, Airport Manager, Concord
Concord Chamber of Commerce, Concord
Contra Costa Times, Martinez
Contra Costa Times, Bureau Chief, Martinez
Dow Chemical, Western Division, Pittsburg
E. I. DuPont De Nemours, Plant Manager, Antioch
General Chemical Company, Pittsburg
Joseph Canciamilla, Pittsburg
League of Conservation Voters, San Francisco
League of Women Voters of the East Bay, Oakland
Los Medanos College, Pittsburg
Martinez Chamber of Commerce, Martinez
Martinez News Gazette, City Desk, Martinez
Mr. Skip Estulla, Concord
Mr. Robertson, Concord
Mrs. Clifford Sealock, Concord
Mt. Diablo Audubon Society, Walnut Creek
Mt. Diablo Hospital, CEO, Concord
Oakley Chamber of Commerce
Park and Shop, Concord
Person Family, Concord
P G and E, Oakland
P G and E, Planning, San Francisco
Pittsburg Post Dispatch, Bureau Chief, Pittsburg
Regional Archaeological Site Survey Northwest Information Center, Department of Anthropology, Rohnert Park
Robinson Family, Concord
San Francisco Examiner, Bureau Chief, Oakland
Shell Oil Company, Martinez
Sierra Club S.F. Bay Chapter, Berkeley
Southern Pacific Transportation, San Francisco
Sun Valley Mall Association, Concord
Thousand Friends of Contra Costa, Brentwood
Tim Stone, Pittsburg
Transit Authority, Manager of Service Development, Walnut Creek

Union Pacific Railroad, Stockton
Willow Shopping Center, Concord

9.7 LIBRARIES

Antioch City Library
501 West 18th Street
Antioch, CA 94509

City of Brentwood Library
751 3rd Street
Brentwood, CA 94513

City of Concord Library
2900 Salvio Street
Concord, CA 94520

City of Pittsburg Library
80 Power Avenue
Pittsburgh, CA 94565

City of Martinez Library
740 Court Street
Martinez, CA 94553